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DESIRABLE INTENSITY OF ILLUMINATION.

Early illuminating-engineering practice was directed largely toward determining the minimum intensity of illumination which would be satisfactory and permit good seeing, and installations were designed with an idea of not greatly exceeding this value, the motive of course being one of economy. With the great development in electrical illuminants and the greatly increased efficiency of light production, there has been a marked tendency to increase illumination intensities above these minimum values and provide conditions which will be pleasant and stimulating, as well as permitting necessary work to be accomplished.

Many compilations have been made of intensities which are desirable in different kinds of structures and in rooms devoted to different purposes. It is not well to follow such values too blindly in any particular case, as it must be remembered that the most desirable intensity is influenced by a great many conditions which will vary from one case to another. The furnishings of a room, the color of wall and ceiling, the percentage of window space, are generally recognized as variables which should receive consideration. There are other variables, however, which should enter into a consideration of the case, but which are frequently neglected.

Among these are the fact that work can be done more quickly under a fairly high intensity than under a lower one. An intensity which may be entirely comfortable where work is done slowly and there is no haste, may prove entirely inadequate where it is necessary to take in a large field or many details at a glance. The eye can work at a rapid rate without fatigue under high intensities when it would not be able to do so under more moderate ones. Again, the intensity of illumination which is most suitable depends to a certain extent upon the size of a room. To see well at longer distances, higher intensities are necessary than to see close at hand. Intensities which are entirely sufficient to see objects close to the observer may be entirely inadequate for distinguishing detail at the other side of a large room. This is well recognized in illuminating the stage of the theater, where high lights are the regular order of the day. A third condition which may be mentioned here is the relation between the necessary intensity and the amount of detail in the work to be accomplished. Within a reasonable range, acuity is greater the higher the intensity, and this should be remembered in planning conditions for any work which involves a discernment of considerable detail.

Only by giving attention to all the physical condi-

tions involved and to the purposes to which illumination is to be applied, will it be possible to plan the most suitable installation, both as to the intensities and to the form of equipment for supplying it in any particular case.

ELECTRICAL PROSPERITY WEEK.

On other pages of this issue report is made concerning the plans which the electrical and allied interests have made for the celebration of Electrical Prosperity Week, November 29 to December 4.

There have been obstacles to overcome, some natural and others forced, but upon the whole the country has responded in hearty fashion. From one end of the land to the other in many forms of attention-compelling display, the advantages of the use of electrical energy and the availability of electrical apparatus to do the work of the world, will be brought in spectacular fashion to the direct notice of the American public.

Any speculation we might make as to the returns which shall be available to those who will bear the brunt of expense and effort would be futile. However, we need not be optimistic in any degree to expect that the rewards will be great. Of course, many who have not contributed in any way will benefit, and those who have carried the burden will in turn be benefited more greatly, for in the future they will have assistance instead of resistance upon the part of those not so easily converted.

Coming as it does just when the country appears to be looking forward to a period of great activity and material prosperity, the date for the celebration appears to have been happily selected. We may all sincerely hope that not one of the expectations of those behind and for the enterprise may fail of realization.

ENTER THE PSYCHOLOGIST.

An interesting instance of the value of collateral scientific research in public utility operation is afforded by tests recently conducted by Dr. J. W. Baird of the department of psychology, Clark University, for the New York Telephone Company. Facing the difficult problem of adding 35,000 names to the directory without reducing the size of type almost to the vanishing point or increasing the number of pages in an already bulky volume, the company requested Dr. Baird to render what assistance he could, based on a broad knowledge of the psychology of optics and printing.

Dr. Baird chose 32 men and women differing in age, sight, education and station in life and by some 4,000 stop-watch tests determined the speed with which numbers could be selected from the directory, comparing various dummy sheets and type arrangements. These showed that the average length of time to find a number in the old three-column book was 10.35 seconds, compared with 9.28 seconds for the new arrangement, which is a four-column book with the type compressed horizontally rather than vertically. There are 11 listings per inch in place of the 12 formerly used and the book actually contains 150 less pages than its predecessor.

Such an instance of the practical success of laboratory methods applied to a purely commercial problem points the way toward other applications of experimental psychology in the public-utility field. The studies of Professor Munsterberg in the direction of employee selection suggest new lines of attack on the riddle of the personal equation, and more is likely to be heard from these methods in the future. It is to be expected that complaints will be registered in the New York case for the reason that some natures always oppose change of whatever kind; but it is hard to see how the company could have done more to solve the problem than this recourse which it took to expert advice.

WAR TAXES ON ELECTRICITY.

One of the inevitable consequences of a costly war is the raising of additional revenue by the Government, and this is usually done by imposing taxes wherever it can be done without creating too stubborn opposition. All manner of taxes arise in war times and they are not always lifted upon the conclusion of peace. One principle of procedure in taxation is to lay taxes most heavily upon those most able to bear them; that is, upon those best able to pay. This is followed out in the case of an income tax, but a great many taxes bear most heavily upon those least able to pay. This is true of all taxes upon the production, importation or merchandising of the necessaries of life or articles in common use. All such taxes upon industry and trade, indeed almost every tax except one upon land values, are shifted to the ultimate consumer, and the largest proportion of consumers in any country are poor people. In spite of the fact that business and industry are most upset in time of war, governments do not hesitate to burden them with taxes, usually overlooking the fact that a tax upon land values would occasion no burden to industry, could not be shifted, and moreover is easy of collection and difficult of evasion, two intensely important points in connection with any revenue-raising policy.

It is not at all surprising, then, to find the Russian Government turning to the electrical industry of that country to find a victim capable of supplying additional revenue. Such a course has been considered in times past, but it was not until the present crisis that the Government finally determined to impose this tax. The tax is based upon the output of electric energy in both public and private power plants and the seller of energy from whom the tax is collected is expressly authorized to add it to the bill of the consumer, which is tantamount to an increasee in the rates for energy supply.

The tax is a graduated one, varying from 0.5 to 4 kopecks per kilowatt-hour. The upper limit applies to residence and office lighting, theaters, etc. The lower limit applies to energy used for heating and industrial power. This practically raises the price of electric

energy from 0.25 to 2 cents per kilowatt-hour. Private plants having a capacity of less than one kilowatt are exempt.

Since the tax falls ultimately upon the consumer, the only direct effect upon the industry is to discourage the use of electricity, and thus reduce the volume of business which would otherwise be transacted. Such reduction might easily reach serious proportions. The total consumption in Russia during 1913 was about 2,000 million kilowatt-hours. This may be compared with the 11,500 million kilowatt-hours in the United States in 1912 supplied by central stations alone. Electric railways and private plants would enormously increase this aggregate. This indicates the undeveloped condition of the industry in Russia, which will be still further retarded by the imposition of the new tax. Taxing an industry never encourages development.

In England the Government has proposed an "excess profits tax," which may bear unjustly on certain elements of the electrical industry. To quote from *Electrical Industries:* "Electric tramway and electric supply companies are subject to limitation of tenure with expropriation at the 'then value' of the plant alone. They are thus on a totally different footing from the ordinary commercial enterprise or from the railway and gas companies, all of which enjoy an unlimited tenure. Most supply and traction undertakings are approaching middle age; they have passed the years of comparatively unprofitable development; and the profits they are now making are to a large extent ear-marked with a view to conserving capital against the day of expropriation. To treat such undertakings on precisely the same level as one which has all eternity before it is obviously unjust. The Excess Profits Tax will not be simply a slice out of abnormal profits; it will be an excessive drain upon both capital and profits."

NOTABLE ELECTRICAL SAFETY RECORD.

By completing four consecutive years without an accident, the electrical department of the famous establishment of the Brown & Sharpe Manufacturing Company, at Providence, R. I., has attained a record unequalled in all other branches of the concern and has furnished an object-lesson of the safety of electrical work when intelligently handled which would be difficult to surpass. Two points of interest occur in this connection. In the first place, the machinery of the plant is group-driven in nearly all departments, a condition naturally resulting in a multitude of shafts and belts which would seem to make minor accidents at least occasional among repairmen. Secondly, the peripatetic nature of the electrical work in such a plant takes the employees of this department through every nook and corner, a factor which is a decided contrast to the conditions surrounding a workman who goes to the same tool or group of tools from day to day, and whose tasks are to so large a degree repetitive. That electrical repairmen should have surpassed all other employees in their freedom from accidents in view of these circumstances, is a tribute both to the care and skill of their work as maintainers, and to the inherent safety of a well installed motor layout and distribution system.

IGNITION OF INFLAMMABLE GASES.

The danger which exists where direct-current commutating machines are operated in an atmosphere containing gases, dust, or other material which may be inflammable, has long been recognized, and in many cases alternating-current motors have been selected in preference to a direct-current installation on this account. This applies in coal mines, in flour and textile mills, and in many other places where dust is created.

It should be remembered in this connection, however, that alternating-current motors are not entirely free from similar possibilities. In the case of machines with slip rings there is a possibility of sparking at the brushes, even though such behavior is much more rare than in the case of direct-current machines. In the case of squirrel-cage rotors there is the possibility of trouble at the points of connection between bars and end rings. Occasionally high resistance at such points may result in the melting of a soldered connection and consequent sparking. Of course such occurrences are extremely rare, whereas the sparking of direct-current machines is extremely common. But it is well to remember that such possibilities exist even in the case of alternating-current motors and care should be taken that the equipment does not reach a condition through neglect where such things may be expected to take place.

ORGANIZATION.

Little is achieved without organization. Individuals may give birth to ideas and propagate them, but accomplishment of results is seldom secured unless men come together and organize and co-ordinate their efforts toward a desired end. This is as true in the electrical industry as elsewhere; and electrical men have recognized it and profited by their perception.

Greater efforts for co-operation between the various elements of the electrical industry have been made during the last few years than ever before. Far-sighted leaders are discerning that better results for all concerned can in the long run be secured if the different elements in the industry pull together than if they are working at loggerheads. There is so much to be done yet in building up the industry and extending the use of electricity, and each element in the total process of manufacturing, delivering and installing equipment and supplying energy for operation can be of so much assistance to the others in extending their respective spheres of usefulness that it seems inane to work otherwise than in harmony. No doubt much of the disposition to do otherwise has come from personal misunderstandings, but much of the friction arises from lack of organization.

Only through organization can each branch of the industry master its own problems and put itself in a position to co-operate with other branches in meeting common problems.

Missouri Telephone Men Hold Annual Convention.

The Missouri Telephone Association held its annual convention in Kansas City, at the Coates House, November 16 and 17, with an attendance of 300. The program began with an address of welcome by R. L. Redpath of the Commercial Club. S. T. Neill of Clinton responded. W. S. Vivian, secretary of the Independent Telephone Association of America, told of the value of association work in the telephone industry.

Hon. John M. Atkinson, chairman of the Public Service Commission of Missouri, delivered an address, in which he carefully explained the purposes of the Commission, and its desire to promote industrial and commercial development, without harrassment of utilities. He expressed gratification that there seemed an increasing tendency towards co-operation by utilities with the Commission.

F. B. MacKinnon, secretary of the National Independent Telephone Association, talked on "Interstate Affairs." W. C. Polk, chief engineer of the Gary System, gave technical and valuable pointers on the cost of building and rebuilding exchanges. C. A. Bennett, auditor of the Gary System, talked on "Accounting for Class C Companies."

The election of officers resulted in the selection of all the former officers, and the executive committee, to serve again, with the exception of the several vice-presidents. The roster now is as follows:

President, Houck McHenry, Jefferson City.

Vice-presidents, A. M. Benedict, Richards; S. D. Thompson, Cameron; C. A. Pratt, Flat River; H. H. Hallman, Warrenton.

Treasurer, A. B. Clarke, Kansas City.

Membership secretary, G. W. Schweer, Windsor.

Secretary, W. W. Johnson, Jefferson City.

Executive committee—H. C. Todd, Maryville; J. A. Hudson, Columbia; C. M. Boutin, Cape Girardeau; C. J. Myers, Kansas City; S. T. Neill, Clinton; M. L. Golliday, Holden; R. A. Guthrie, Macon; G. V. Ross, Kansas City; W. H. Bassett, St. Louis.

Lynn Section Meeting.

On November 17, H. H. Barnes, Jr., of the General Electric Company, New York, spoke on "How New York Gets Its Electric Light and Power," before the Lynn Section of the American Institute of Electrical Engineers. Some 300 were in attendance at the lecture, which was illustrated by lantern slides. One view showed a 30,000-kilowatt turbine. Mention was made of the vast quantity of coal needed, as there are no water powers near New York City. The New York Edison has on hand a supply of 160,000 tons of coal at all times, and the combined stations use about 600,000 tons per year.

The large storage-battery equipment for use in emergencies was referred to and several million dollars have been invested in this. These batteries would take care of the maximum load for a period of seven or eight minutes, if needed, without any aid from the other generating units.

On December 1, J. W. Powell, of the Fore River Ship Building Company, will speak before the section.

Electrical Exports for September.

The following facts regarding the September electrical exports of the United States are obtained from the monthly summary of the foreign commerce of the country just issued by the Bureau of Foreign and Domestic Commerce, Washington, D. C.

During last September the total value of the electrical shipments exceeded that of every month since October, 1913. For the four electrical classes for which the number of articles exported is given in the government reports, there were exported in September the following: electric fans, 2,364; arc lamps, 32; carbon-filament lamps, 59,515; metal-filament lamps, 791,407. The latter is believed to be the largest number of these lamps ever exported from the United States in any one month.

The following table gives the detailed figures for September and for the corresponding month a year ago:

Articles	Sept. 1915	Sept. 1914
Batteries	$ 123,377	$ 38,425
Dynamos or generators	109,990	119,756
Fans	33,193	18,029
Insulated wire and cables	318,478	91,375
Interior wiring supplies, etc. (including fixtures)	57,871	34,156
Lamps—		
Arc	397	1,465
Carbon-filament	7,041	9,960
Metal-filament	118,464	30,988
Meters and other measuring instruments	51,044	14,375
Motors	417,375	315,115
Telegraph instruments (including wireless apparatus)	5,681	3,791
Telephones	37,180	158,922
Transformers	76,433	26,871
All other	906,767	685,240
Total	$2,263,291	$1,548,468

The total value of all electrical exports for the first nine months of 1915 was $17,240,731, compared with $15,203,037 for the corresponding period of 1914, and $21,203,489 in 1913.

National Electric Light Convention to Be Held in Chicago.

Announcement has been made by E. W. Lloyd, president of the National Electric Light Association, that the next annual convention will be held in Chicago, early in June.

The Faraday Society.

At the annual general meeting of the Faraday Society, held on October 19, the following officers were elected to serve for the year 1915-16:

President: Sir Robert Hadfield.

Vice-presidents: K. Birkeland, Bertram Blount, W. R. Bousfield, F. G. Donnan, Eugene Haanel, A. K. Huntington, T. Martin Lowry.

Treasurer: F. Mollwo Perkin.

Council: W. R. Cooper, C. H. Desch, J. A. Harker, Emil Hatschek, Cosmo Johns, Alfred W. Porter, E. H. Rayner, A. Gordon Salamon, George Senter, M. E. Stassano.

The following papers were taken as read:

"The Transference of Electricity by Colloidal Particles," by F. Powis.

An attempt is made to calculate the charge carried by the particles of a colloidal solution produced by sparking, (1) from a modification of Stokes' formula, (2) from the increase in conductivity on making the solution. Although the data available for the calculations are not very satisfactory, the second method gives a value much greater than the first. The author believes this is because the particles are not like the ions of an electrolyte solution, but that anions and cations are absorbed on their surface in such a way that the concentration of each gradually decreases with increasing distance from the particle, until each finally becomes equal to that in the bulk of the surrounding medium. The ions are so arranged, however, that with a negative colloid the layers nearer the particle contain an excess of anions, and those further away an excess of cations, while with a positive colloid this is reversed.

"Electrolysis of (A) Nitric Acid, (B) Sulphuric Acid, (C) Orthophosphoric Acid, Using a Gold Anode," by F. H. Jeffery.

"Electrolysis of Concentrated Hydrochloric Acid Using a Copper Anode," by F. H. Jeffery.

"The Thermal Decomposition of Hydrogen Peroxide in Aqueous Solution," by William Clayton.

Electric Club Nominates Officers.

At the meeting of the Electric Club Jovian League of Chicago on November 18, P. R. Boole, chairman of the Nominating Committee, presented a report nominating the following ticket:

President, V. H. Tousley.
Vice-president, H. A. Mott.
Vice-president, J. C. Manley.
Secretary, L. C. Spake.
Treasurer, H. Ehrlich.
Trustees: A. J. McGivern, J. N. Pierce and R. I. Phillips.

Rejuvenation in Kansas City.

The Jovians in Kansas City, Mo., will hold a rejuvenation on the evening of December 4 at the Coates Hotel.

Industrial Power Series—Article No. 145

ELECTRICITY IN MARBLE QUARRYING.

This article describes the installation in the marble quarries and finishing plants of the Vermont Marble Company. There are at present in service a total of 570 motors with an aggregate rating of approximately 14,000 horsepower. A portion of the energy used is purchased from a transmission company.

The use of electric drive in modern industry is coming to be well-nigh universal. On account of the scattered nature of marble mining operations, and the heavy and more or less crude tasks involved in manufacturing and finishing, it might seem as if the use of a more rudimentary form of power application would be more appropriate to the work. The plants of the Vermont Marble Company, are, however, entirely electrified, and the quarrying is also done with the exclusive use of motored machines.

This company is said to be the largest producer, and its product the finest, in the world. Vermont marble ranges from the purest white, rivalling the Grecian, to variegated stone of high value for interior decorative purposes. The Vermont Marble Company's output is about a million cubic yards a year, it being shipped over almost the entire globe, in polished, sculptured and natural forms.

A birdseye view of the plant is necessary to a proper appreciation of the extent of the industry. On the western side of the Green Mountain State, extending for about 50 miles, are many outcroppings of marble, and other deposits are hidden under the earth, in the river valleys. The Vermont Marble Company owns 26,500 acres of the finest marble bearing lands, which are an adequate source of supply for many years to come.

Generally, the quarries and plants are near the valley of Otter Creek, a swift stream, which flows northward through western Vermont and empties into Lake Champlain. The remarkably large fall has been taken advantage of as a producer of power, and four hydroelectric plants have been built to generate electrical energy which is sent over a network of transmission lines more than 100 miles in extent, besides secondary feeder lines, which serve the various quarries and mills.

By this means, quarries, shops, finishing mills and transportation agencies are provided with a flexible source of power, capable of handling the motor installation of about 14,000 horsepower, scattered through 75 quarries, and a dozen shops and mills having floor space of 27 acres. The operation of some of the largest motored machines is very intermittent. Hoists, which lift the stone from the deep quarries to ground level have short, but strenuous duty. This is adequately cared for, however, by the running of partly loaded synchronous motors which supply a compensating leading current and maintain a power factor of 80 to 85 per cent.

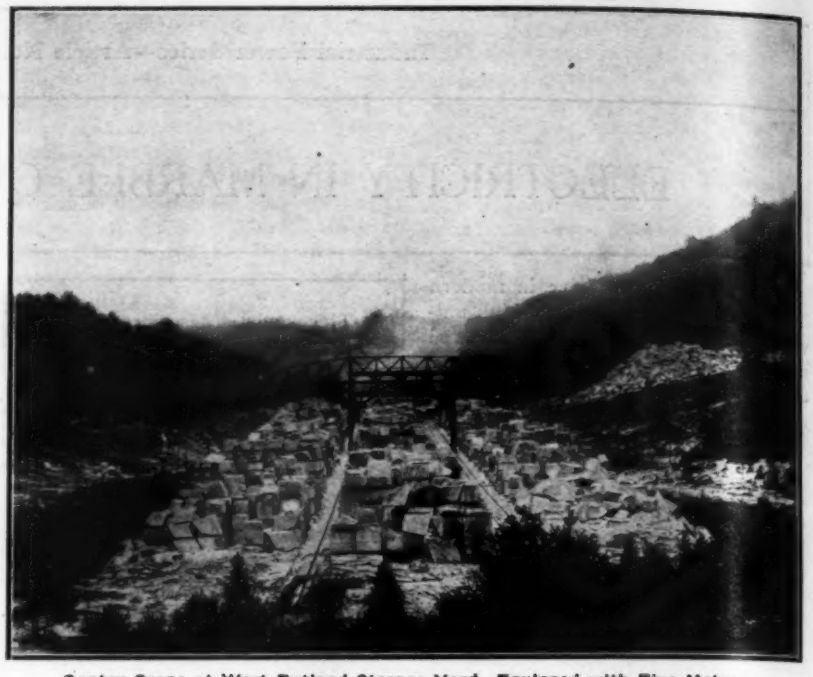
There are in all 570 motors, mostly operating on 440 volts, 3-phase energy.

Channeler at Work at Wall of Quarry—Vermont Marble Company.

These run saws and finishing machines in groups, and are of varying capacities up to 250 horsepower. Drilling, hoisting and locomotive work is performed mainly by direct-current motors operated from motor generators located in various stations, and in certain instances 2,300-volt induction motors are operated, notably in connection with the shaft drive of an entire mill. For example, a 150-horsepower, 2,300-volt alternating-current motor is a chief power equipment of the Belden mill, and a 200-horsepower induction motor drives the Ripley mill and a 100-horsepower motor of the same type is installed at Brandon.

For quarry use 220-volt windings operate pumps, hoists, channelers and pulsators for air drills. Roughly, most of the monumental work is done at the largest mill, at Proctor, the bulk of the finishing for interior display is done at Center Rutland and switchboard and monumental work are both carried on at Florence. Danby has one of the busiest quarries of the system. Here the outcroppings of marble are on a mountain side and a railway about a mile long, with balanced cars, brings the marble blocks to the base of the mountain from the quarry above. The line has a drop of 1,200 feet, the maximum grade being about 45 per cent. Each of the cars has a capacity of 50 tons, and they are run by a cable and drum operated by a 75-horsepower motor on 220-volts pressure.

At West Rutland is a quarry 300 feet deep, with tunnels extending laterally 2,200 feet. A Baldwin electric locomotive is used to haul the blocks, weighing about 15 tons each, from the end of the mine to the foot of a hoist by which they are elevated to the surface. The locomotive is operated on 220 volts direct current supplied to a feed wire erected on posts about 18 inches high, on one side of the track. Hoists are operated either with direct current or phase-wound rotor 440 and 220 volts alternating current, the latter the more general type. All hoists and derrick motors are provided with variable speed control.



Gantry Crane at West Rutland Storage Yard—Equipped with Five Motors.

Lines are carried from pole lines at the brink of the quarries to crossarms attached to the walls of the quarry by lag screws, as shown in an accompanying illustration. Triple-braid weatherproof wires are used in quarry work, and where cables are required they are rubber covered.

Electric lighting by 250-watt Mazda lamps is provided where natural light is insufficient. These units are mounted on weatherproof sockets, and some units have been connected across 220-volt power circuits with fairly good result, and two lamps in series have also been tried on power circuits. The minimizing of power lines in quarries and tunnels is of course an advantage to be desired.

The process of mining marble is first to operate a channeler, which is mounted on a car running on a temporary track along the quarry floor. The machine is provided, in most cases, with a single chisel gang which is given a positive reciprocating motion by means of compressed air supplied by a motor-driven compressor equipped with a 12-horsepower induction motor mounted on the car carrying the compressor and other equipment, and operating at 720 revolutions per minute on 220 volts. A new type of chisel gang can channel both on level surfaces and on slopes, and in this way is a great advance over the earlier type of double-lever machine which could operate only on level surfaces. The strata of marble in general lie in a nearly horizontal position, but sometimes are at an angle. Of the double-lever channelers there are now about 25 in operation, each driven by a 12-horsepower railway-type direct-current motor installed about 20 years ago and still giving unimpaired efficiency.

The channeler, as the name implies, moves forward constantly, cutting a deep groove in the stone. Afterward cross channels are cut, about four

Channeling Machine and Pump Driven by 12-Horsepower Motor.

Diamond-Disk Circular Saw for Cutting Marble.

feet deep, and the base of the blocks is drilled and wedged and the block thus broken off, at its natural cleavage in most cases. After the first, or key block has been removed, the remaining squares of marble can be taken out whole with little mechanical difficulty. Blasting has no place in modern marble quarrying.

The drills used operate under air pressure, each from a motor-driven air compressor geared to a two-speed 5.5-horsepower induction motor, both drill and compressor being mounted on low wheels and readily moved along the quarry floor. There are about 220 quarry machines of the various types in use at the Vermont Marble Company's quarries.

Derrick hoists equipped with hoisting motors of 25 to 165 horsepower are used in elevating the blocks, with a 5 or 6-horsepower motor connected to swing the derrick. There are about 80 of these units in operation.

When brought to the surface, the marble blocks are deposited on flat cars and hauled to the mills or placed in storage yards by electrically-operated cranes. About one year's output of marble is generally kept in reserve in the yards.

One storage crane of the Gantry type which serves the block pile at West Rutland is equipped with five motors, one of 35 horsepower for the bridge, two hoist motors of 30 horsepower each, and two 7.5-horsepower motors for the trolleys. The crane has a bridge span of 160 feet and a capacity of 50 tons.

The mills at which sawing of marble is done are equipped with gang saws, consisting of toothless iron blades, 4 inches wide and one-eighth inch thick. These are suspended on a swinging frame which is actuated by belting connected to counter shafts overhead. From 12 to 40 saws operate in a group from a single shaft driven by a motor of 75 to 250 horsepower. An average of 100 horsepower for 14 gangs, is required, which includes the necessary power to operate sand pumps, which deliver sand and water to the cuts as the saws wear their way through the block. Some idea of the hardness of the stone may be gained from the fact that it requires anywhere from three to ten days of 24 hours' continuous sawing to slice an average block into slabs. The time depends on the number of blades in the gang, the hardness and the size of the block. Some blocks contain quartz or other material which renders them almost impervious to the action of the saws, and hence have to be abandoned.

There are 436 gang saws in all the company's plants, and they are operated night and day. Owing to the simplicity of the mechanism the saws require little attention, they having to be watched from time to time to note the progress of the cutting and to see that bearings, etc., are lubricated. The connected load in motors running saws is about 2,500 horsepower, the usual motor being of the constant-speed squirrel-cage type.

A noteworthy feature of the cutting processes is a diamond disk circular saw about five feet in diameter. There are 50 teeth set in the rim, each provided with two or more diamonds, which are imperfect stones that have been rejected for other purposes. They represent in all a cost of about $400. The saw operates at 400 revolutions per minute, is driven by a 25-horsepower motor and a three-horsepower motor on the feed, and is used chiefly to split small blocks and slabs that require prompt handling. A block, say 5 feet long and 12 inches square, can be given one lengthwise cut in about 15 minutes, whereas with the cross-cut saw perhaps a whole day would be consumed. Teeth are re-set after

Derrick Hoist Operated by 165-Horsepower Motor.

worn smooth, the diamonds being changed so as to present a fresh corner, or else renewed. A view of this machine is shown in one of the accompanying illustrations.

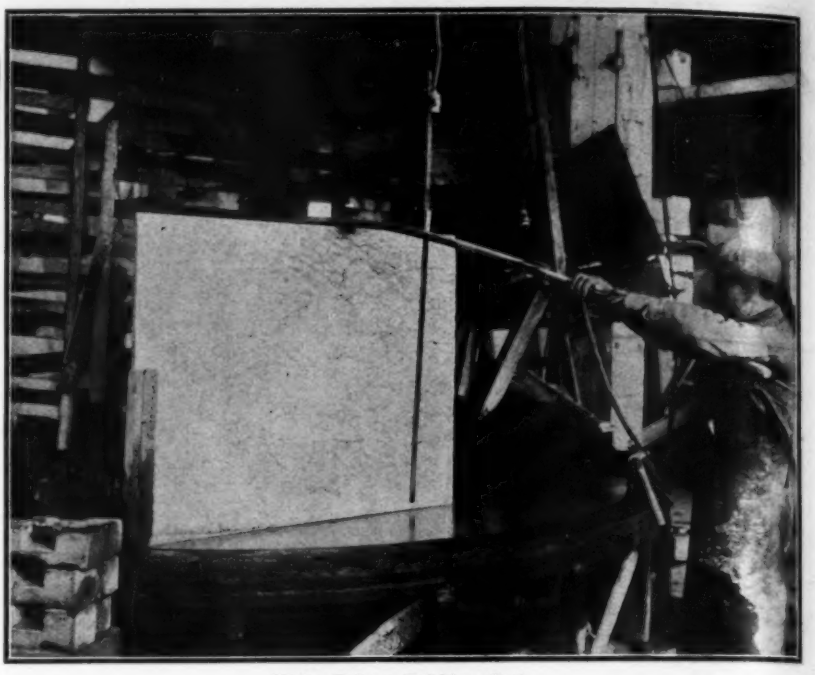
In the cutting processes a great amount of sand is required. This is brought to the Proctor plant from a deposit of sharp quartz sand suited to the purpose, about 2.25 miles distant, and is transported thence across a valley and over a hill by means of a suspended cable way. Buckets holding 500 pounds are hauled to the mill at the rate of one every 50 seconds. During a day of 24 hours' operation 1,728 buckets full enter the mill. The cars are propelled by means of a motored drum located in the upper story of the mill, near where the buckets are emptied.

The finishing shops are equipped with 65 rubbing beds operated in groups of 5 or 6 machines, from counter shafts by 50-horsepower motors, though some of the latest installations are individually motored. Lathes for turning columns as long as 32 feet are equipped with motors of about 10 horsepower each, or for two lathes, a relatively small amount of power being required, owing to the slow speed at which the columns are turned. Carborundum beds, used to cut grooves in pieces of marble, with slow reciprocal travel like that of a planer, are driven individually by motors of about 20 horsepower.

There are also a large number of pneumatic hand tools used in the shops, air being supplied at about 50 pounds pressure by motored compressors.

A new adaptation of electric drive will be the motor equipment of a lime hydrating and burning plant now under construction at West Rutland. Waste marble will be crushed and rolled, and converted into lime. About 23 motors, some of large capacity, will be installed to perform the various duties that require power, such as crushing, grinding, hoisting, conveying, etc.

The principal generating station from which the Vermont Marble Company obtains its electrical energy is at Proctor, near the large monumental works, and here a 120-foot head is utilized. In the early days mechanical drive was availed of, but now the plant, as well as three newer stations on the same stream, Otter Creek, are utilized as hydroelectric stations. In the Proctor station are installed three 750-kilowatt, 480-volt, 514 revolutions per minute vertical-shaft generators direct-connected to I. P. Morris water wheels of 1,200 horsepower each. There are three 500-kilowatt 480/11,000-volt single-phase transformers for supplying the 11,000-volt inter-plant line, one 1,250-kilowatt, 11,000/13,200-volt three-phase transformer for stepup for supplying the connecting line to Mendow station of the Rutland Railway, Light & Power Company, and a 150-kilowatt motor-generator set for supplying direct-current energy to hoists, elevators and cranes in the Proctor plant.



Motor-Driven Rubbing Bed.

Other generating stations are: a 1,500-kilowatt hydroelectric station at Huntington Falls, where a 40-foot head is utilized; a station of the same capacity at Beldens, operating under the same head, and a 275-kilowatt station at Center Rutland, under a 30-foot head. The Huntington and Beldens stations generate 2,300-volt energy, and the Center Rutland station 460-volt energy. By means of a 44,000-volt tranmission line 60 miles in length the various plants are tied in together, and also connected with two small auxiliary steam stations used merely for standby service. An 11,000-volt line ramifies to substations at the various quarries and manufacturing plants, where are located transformers for stepdown to voltages suitable to the local conditions of motor service.

Motor-Driven Gang Saw.

Commercial Practice
Management, Rates, New Business

Offices that Invite Public Confidence.

The accompanying illustration shows a section of the new-business department offices of the Columbus Railway, Light & Power Company, Columbus, O. The significant point in the construction of these offices is that all partitions are of clear glass, thus enabling a visitor to see at a glance whether an employee they wish to see is engaged or not. Further, it is not necessary to send a card or name to anyone. The visitor is always permitted to walk unannounced into any of the offices.

Section of Offices of Columbus Company Where Clear-Glass Partitions Are Used.

W. A. Wolls, manager of the commercial department of the company takes particular pride in the arrangement of offices and believes that it is an important step in dispelling criticism to the effect that a utility business is mysterious and that utility officials are difficult to interview.

Heating-Pad Campaign at Augusta.

"A real comforter" is what the Central Maine Power Company, Augusta, Me., terms the electric heating pad, in advertisements in local newspapers. Pain can be eliminated by the application of heat, it says, and the most convenient and reliable source, day or night, is the electric pad.

Ohio New-Business Men Hold Profitable Convention.

About 50 representatives of central stations from Ohio and vicinity were in attendance at the convention of the Committee on New Business Co-operation of the Ohio Electric Light Association which was held in the Club Rooms of the Middletown Gas & Electric Company, Middletown, O., on Wednesday, November 17.

Chairman J. E. North, commercial manager of the Springfield Light, Heat & Power Company, Springfield, Ohio, opened the meeting and introduced L. C. Anderson, a member of the Executive Committee of the Ohio Electric Light Association, and the general manager of the Middletown Gas & Electric Company, who extended a very hearty welcome to the delegates to Middletown, and expressed the wish that they would all benefit by the papers that would be presented. Mr. Anderson expressed the belief that at this time the United States was enjoying a period of prosperity and that in his mind the electrical industry was possibly benefiting, or going to benefit the most.

The first paper was by W. A. Wadsworth, assistant commercial manager of the Union Gas & Electric Company, Cincinnati, entitled "Electrical Advertising."

In the discussion that followed the presenting of the paper, Mr. Wadsworth stated that the practice in Cincinnati of installing large type "C" Mazda lamps in front of stores was being discontinued and that efforts were now being made to secure an electric sign or exterior decorative lighting. F. C. Morrison of the Ohio Light & Power Company, Newark, stated that the use of large type "C" lamps on the exterior of the stores in Newark had not affected the window-lighting business. Mr. Wadsworth also stated that in Cincinnati at the present time, an active campaign was in progress to secure window lighting and that trial installations were being made.

Following the discussion on this paper, Chairman North asked what arrangements had been made by the different cities represented in connection with Electrical Prosperity Week, and Mr. Wadsworth told the plans for Cincinnati; Mr. North regarding Springfield; A. L. Young, manager of the Toledo Railways & Light Company, about Toledo, and Thomas F. Kelly, commercial manager of the Dayton Power & Light Company, regarding Dayton.

The next paper presented was by H. J. Kunz, of the Toledo Railways & Light Company, entitled "Power Sales Problems."

In the discussion following this paper, Mr. Wadsworth outlined the importance of not over-estimating a proposition to a prospective power customer. He also stated that he believed that the greater portion of the sales effort should be made on the person who would have the signing of the contract, rather than on the engineers and firemen. He also claimed to be a believer in employing power salesmen instead of power engineers, and was a great advocate of the trial period for securing power business.

F. B. Steele, commercial engineer of the Dayton Power & Light Company, said he was heartily in favor of trial periods of from 30, 60 to 90 days. Mr. Steele stated that he believed in studying the conditions in the plant of a power prospect, because such data, when presented to the prospective customer, secured his attention and aroused interest. Mr. Kunz stated

that he believed that a power salesman would necessarily have to have practically the same qualifications as a power engineer.

The convention adjourned at the noon hour. Luncheon was held at the United States Hotel, and the afternoon session started at 2 o'clock, when a paper was presented by F. S. Dellenbaugh, Jr., Westinghouse Electric & Manufacturing Company, entitled "Increasing Small Motor Loads on Central-Station Circuits."

Mr. North in opening the discussion brought out the fact that most central stations were not in the merchandise business and therefore he questioned whether the sales expense would warrant much time being spent in endeavoring to sell small electric motors.

Mr. Lafferty, of the Robbins & Myers Company, Springfield, said the sale of small motors should be made through the combined co-operation of the manufacturer of the apparatus using the small motor, the small motor manufacturer and the central station.

Mr. Dellenbaugh, Jr., in the discussion stated that he estimated 250,000 pieces of apparatus operated by small electric motors had been sold in 1915 by 263 manufacturers of motor-driven apparatus.

Mr. Steele of Dayton told of an interesting installation of six 0.25-horsepower, three-phase motors that were being installed in Dayton by the C., H. & D. Railroad Company, for lowering and raising gates at grade crossings.

Following the discussion on this paper, the delegates were conveyed in automobiles to the plant of the American Rolling Mills Company, where by arrangement of Mr. Anderson, and through the courtesy of the officers of the mills, the delegates were shown through the entire plant.

Mr. North, when adjourning the meeting, announced that the next convention of this committee would be held at Akron, Ohio, on Wednesday, January 19, and promised a very interesting and educating program on this occasion.

Electric Motor Prevents Water Famine in Brownwood.

On Thursday, November 4, trouble was experienced at the Brownwood (Tex.) city pumping plant with one of the cylinders on a producer gas engine. The plant was in bad shape and only recently the city had ordered new equipment, it having been decided to change from producer gas and steam to electric power. Soon after the trouble started the cylinder cracked so badly as to make the engine inoperative and the city faced a water famine.

Within a few hours after the accident an emergency installation of a motor which happened to be in Brownwood was made. Fearing, however, that trouble would be experienced on account of the heavy overload which it was necessary that this motor carry, Manager Murphy, of the Texas Power & Light Company, got in touch with the Dallas office of the company in hopes of getting a larger motor. By evening a 100-horsepower motor and pulley had been located and a crew was set to work getting same ready to put abroad a passenger train the next morning.

The motor weighing nearly 5,000 pounds left Ferris, Texas, the next day by express and so urgent was the case that it was necessary to hold up two passenger trains a total of 45 minutes. The Texas & Pacific passenger train was held in Dallas 25 minutes to enable the motor to be transferred and again in Forth Worth the Frisco passenger was held 20 minutes for transfer at that point.

The big machine arrived safely in Brownwood without delay and was met at the station by a crew of men who took it to the water works and installed it. It was started Saturday afternoon at four o'clock and ran continuously until six o'clock Sunday night, raising the supply of water in the reservoir some four feet.

An electric cable has been laid for industrial power-transmission purposes between Helsingborg, in Sweden, and the opposite coast of Denmark. It is capable of transmitting energy at 40,000 volts.

Window Displays to Boost Electricity.

Kansas City will exploit electricity in some way in every downtown and suburban display window. This prospect is assured by the promise of co-operation with the window-display program, by the Merchants' Association of Kansas City. F. B. Uhrig, chairman of the committee of the Jovian Electric Club of Kansas City, took the matter up with the Merchants' Association, and received assurances that all the members of that association would make special displays.

The windows of electrical contractors, dealers in electrical goods, and merchants who handle any electrical devices, will have a uniform system of display. The sample window upon which the others will be modeled was prepared November 19 by the Kansas City Electric Light Company. A view of this window is shown in the accompanying illustration.

Model Window Display of Kansas City Electric Light Company.

Municipal Plant Inadequate to Supply Power Needs of Merrimac.

The inadequacy of isolated generating plants, built for small town lighting purposes, to meet the power situation where large blocks of electric power are in demand, is shown in the case of the municipal plant at Merrimac, Mass., where a large foundry company which has important orders to fill, says that it must move to a new location unless it can secure a sufficient supply of electric power. The solution of the difficulty seems to be to resort to purchased energy, from

the Amesbury Electric Light Company, and a committee, consisting of the selectmen and electric light commissioner of Merrimac, is considering the matter.

Here is a situation where syndicate plants having physical connection and inter-relations have a marked advantage. Many of the larger industrial centers of New England are thus provided, notably in Maine, where three large companies, all utilizing water power generation, serve a myriad factories once using hydraulic or steam power. Other similarly situated industries are those on the Connecticut River, in Vermont and Massachusetts, which draw on the recently developed power resources of the Deerfield and Connecticut Rivers for their electricity.

The difficulty of a small steam plant to stand alone is accentuated by such sudden demands for service as the foundry company referred to has made.

Janesville Company Participates in Trade Celebration.

The accompanying illustrations show two views of the booth of the Janesville (Wis.) Electric Company at the recent celebration of "Made in Janesville" week.

The company equipped an electric kitchen and had a lady demonstrate the merits of the electric stove and percolator by serving cup cakes and coffee. An electric laundry was also equipped.

There was an exceptionally fine line of reading lamps and cooking utensils. The color scheme was black and white which materially aided the lighting effects and the display of the cooking devices.

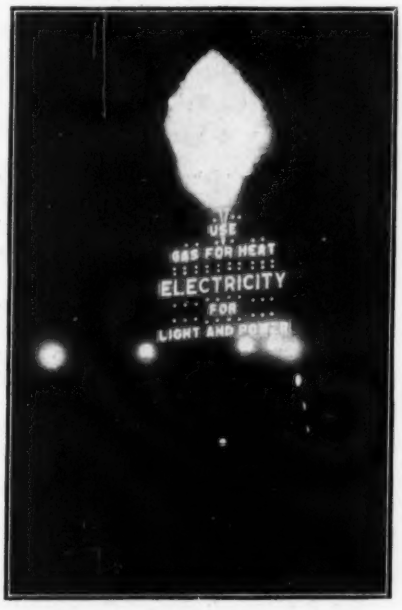
Vacuum cleaners, sewing machine motors, fireless cookers with automatic electric heating devices, electric fixtures and boudoir lamps were among the many articles on display.

Comfortable chairs served to entice those interested in electrical goods to spend more time at the booth.

The company expects to reap many sales as a direct result of this exhibit. The new-business department is under the management of H. R. Wagenknecht.

Spectacular Gas and Electric Sign in Louisville Attracts Attention.

The combined gas and electric sign of the Louisville Gas & Electric Company, which is shown in the accompanying illustration, is attracting considerable attention in Louisville. This is declared by the sign experts to be the first combined use of gas and electricity in a sign of this character. It is the idea of Robert Montgomery, manager of the commercial department



Combined Gas and Electric Sign of Louisville Company.

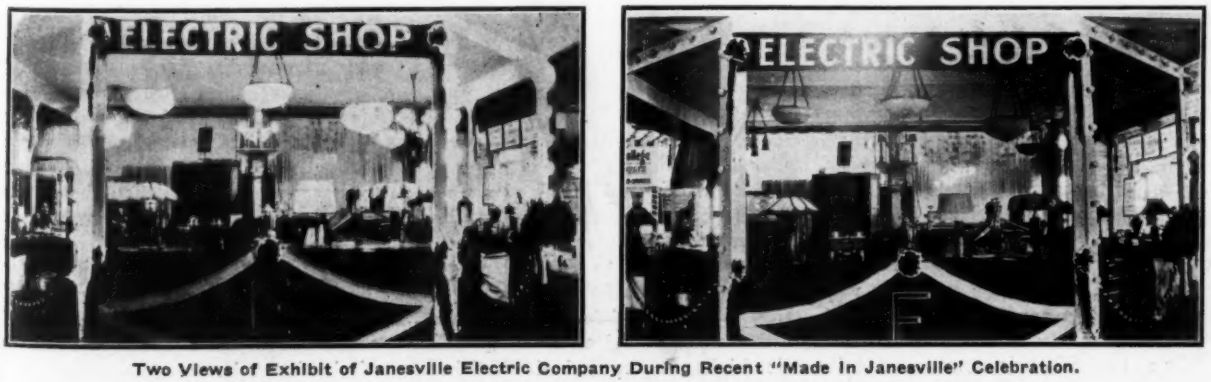
of the Louisville company, and was built according to Mr. Montgomery's plans. From the outset it attracted a great deal of attention and is one sign in which Louisville people, when they get down town, never fail to look for and to read.

The electrical part of the sign is not unusual in its general aspects. But combined with the gas torch it is novel and striking and should certainly, if there is efficacy in advertising, get results. From the night view a general idea of the sign can be determined. It is erected on the top of the general offices of the Louisville Gas & Electric Company, on Chestnut Street. In dimensions the sign is about 35 feet in height from the bottom line to the top of the torch and 25 feet in width at its widest point. The gas torch, with a flare at the top, is outlined with small lamps and painted red to mark it from the remainder of the framework. The flambeau shows first, on still nights rising to a height of 20 feet. It is followed by the first section, "Use Gas for Heat" and that by "Electricity for Light and Power." The whole repeats and is followed by twinkling of the stars which show as small lights.

The gas flame at the top is fed by a 1.5-inch supply pipe, the flow of gas being regulated by a butterfly valve, which is controlled by a lever arm attached to a flasher, especially made for this job. The butterfly valve is so connected to an induction coil that as it opens, the current is set up and a spark created which ignites the gas. The letters are all 16-inch porcelain-enameled letters, with the exception of those in the word "Electricity" which are 24-inch, also porcelain enameled. There are 437 10-watt, 110-volt Mazda lamps used, and the whole is in operation for an average of six hours a night, from dusk to midnight.

The idea in using gas in this manner is to create the impression that there is plenty of it—which with a natural gas supply and more or less popular uncertainty as to how long the supply will hold out, is considered an important item. Several actual instances are on record of comments on the sign which put the emphasis on the statement that there must be a lot of gas available or the company could not afford to burn it that way.

As a matter of fact only a small amount of gas is used, the consumption averaging approximately 2,000 feet a day. At the prevailing retail rate of 35 cents, after a given quantity has been consumed, this means that the cost for the gas is 65 or 70 cents a day. Before the spark-ignition system was installed, a pilot flame was kept burning to light the gas, and during that period a consumption at the rate of 8,000 cubic feet was the rule. The spark, igniting the gas, released at a pressure of five ounces to the inch,



Two Views of Exhibit of Janesville Electric Company During Recent "Made in Janesville" Celebration.

obviates the big consumption, and, according to Mr. Montgomery, the gas used costs considerably less than the electric current.

Another interesting feature of this sign from the viewpoint of the electric salesman, is the fact that the more or less customary "lightning flashes" are conspicuously absent from the sign. That is one of Mr. Montgomery's cardinal electricity advertising principles. There is still too much tendency on the part of the general public to confuse electric current and lightning, he feels, and, although a simulated lightning flash may be graphic, it gives a wrong impression to lots of people, who do not appreciate the degree of safety with which electricity is handled. That is the explanation for the stars instead of electric flashes.

Denver Company Conducts Strenuous Prosperity Week Campaign.

The main celebration of Electrical Prosperity Week in Denver, Colo., will begin Monday, November 29. For six weeks an advertising campaign to acquaint the people of the state and of the city of Denver with the nation-wide electrical movement has been conducted by John M. Connelly, publicity manager for the Denver Gas & Electric Light Company.

Every proposition that would give the people an idea of the monster celebration of electrical prosperity has been utilized. Newspapers, booklets, billboards and Denver magazines have been used to bring the celebration before the attention of the people. An electric show, conducted under the auspices of the Colorado Electric Club, the allied electrical interests of the city, the Denver Gas & Electric Light Company and the various manufacturers, will be a main feature of the week. At this show electricity, its adaptability to manufacturing, its use in the home as a lighting, cooking and a medium of reducing household work will be shown.

On the eve of the opening of the show, it gives promise of being the most successful exhibition of the uses of electricity that has ever been held in Denver. Every foot of floor space in the Auditorium, a building covering a full half square, has been sold and the various manufacturers with branches in Denver will attempt to demonstrate the uses of electricity in a manner that has never before been shown here.

Early in the advertising campaign to give publicity to the use of electricity, the idea was conceived that business men, local manufacturers and housewives must be interested. To this end a unique advertising campaign was instituted. The newspapers were used extensively to attain this end.

The ads used in this connection probably are unique examples of what may be done to interest the manufacturer in the use of electric energy and at the same time gain his good will. It was the aim of those who conceived the idea to give the various manufacturers as much publicity as was given the electric show and "Electrical Prosperity Week."

Certain of the bigger manufacturers of the city were selected and advertisements with the heading "Electrical Prosperity Week," a few words about the show and then a lengthy discourse on the particular business of the manufacturer spoken of and the uses to which electricity had been put in the particular line of manufacturing, were used in all advertisements.

These were placed in newspapers and considerable space was used. This, in the opinion of Denver electrical men, had the advantage of gaining the good will of the manufacturer so advertised and it also pleased the newspapers in which the advertisements were inserted, causing them to give wider publicity to the electric show and "Electrical Prosperity Week."

In order to get away from the thought that the electric show was to be a purely mechanical exhibition of the work performed daily by electric current, the electrical men considered that some feature that would make a general appeal and attract attendance to the Auditorium during the week of the exposition was considered.

As a result the suggestion was made that an electrical queen be selected. For several weeks before the queen, who was called "Electra," was chosen extensive publicity notice was given by all the Denver newspapers. The queen, whose name will not be revealed until opening night, was selected several weeks before the opening of the exposition in the club rooms of the Colorado Electric Club.

Nearly 100 young women of the city responded to the appeal for beautiful women to qualify for the honor of being "Electra" queen of "Electrical Prosperity Week." Those who competed in the plan were selected by five of Colorado's best known artists, men and women who also have national reputations. The winner of the competition was given a prize of $25 by the electrical men.

Photographs of the young woman finally selected as "Electra" were published in all the Denver newspapers. Her facial features were not revealed to the general public, as she wore a mask to cover them. This plan, it was believed, would serve to attract hundreds of persons to the electric show to get a glimpse of the queen of "Electrical Prosperity Week."

Meanwhile, the Denver Gas & Electric Light Company had published a booklet advertising the "Prosperity Week," electrical appliances and the queen of the electric show. The booklet attracted wide attention and served a triple purpose. It advertised every electrical appliance used in the household, gave publicity to the electric show and also the week.

This booklet was mailed to every person considered a prospective buyer of appliances. The plan served to bring the attention of the women of Denver to the use of electric current and electrical appliances. The booklet was published in colors and with attractive illustrations, calculated to catch the eye of every woman in the city.

New York Electric Car Campaign.

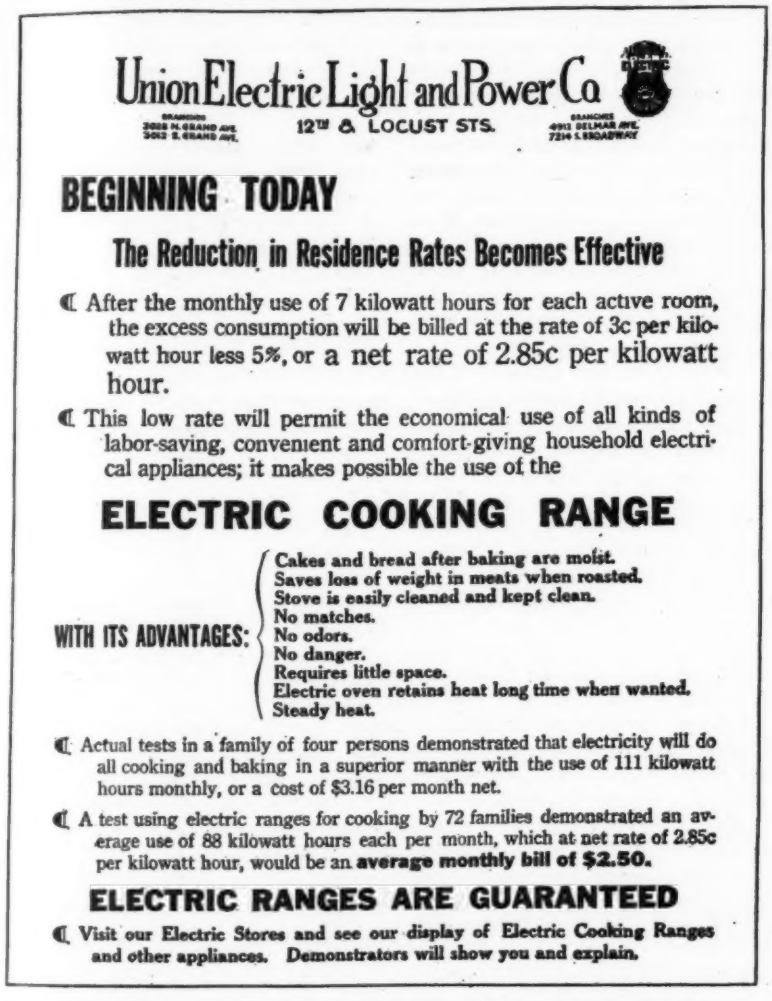
Excellent success has been achieved in the special sales campaign in behalf of the Ward Special, a 750-pound-capacity electric delivery wagon. This campaign and the special offer made with it was restricted to Greater New York, nearby New Jersey, Long Island and Westchester County and was to end October 31.

So many inquiries have been received, however, that it was impossible to attend to them within the allotted time. At the unanimous request of all the co-operating companies, the Ward Motor Vehicle Company agreed to extend the period of the special offer to December 4, which is the final day of Electrical Prosperity Week.

There are a number of special features connected with this novel sales campaign. The work is jointly shared by the manufacturer and the electric light and power companies operating in the territory covered. The vehicle in whose interests it is conducted, is the first low-priced electric placed on the market. The price, $875, includes a year's rental of an Edison storage battery. The rental charge for the battery after the first year will be $10.50 a month with an additional charge of 1.75 cents a mile, for monthly mileage in excess of 625. Another feature is the arrangement for time payments.

This campaign is especially directed toward the neighborhood merchant, who uses one, or perhaps two horses, with an occasional need for another. Cost data have been carefully prepared and presented. For instance, it is shown that there are 50 stables on Manhattan Island where one of these Ward Specials can be stored and washed for $10 a month. The cost for current, for more than the distance that a horse delivery wagon makes each day under favorable conditions, would be another $10. Against this is the cost of $28 or $30 a month for stabling and feeding a horse. The cost of tires just about equals the cost of shoeing a horse.

The real advantage of the electric vehicle, however, is that it can readily cover about 45 miles a day and the only real cost increase is in current consumed. This fact was proven in the long cross-country run made by one of these Ward Specials last month from New York to Cleveland. With such tangible figures showing marked economy in delivery cost, it is not strange that this campaign succeeded in interesting the small merchants as well as many doing business on a large scale.


Union Electric Light and Power Co
12TH & LOCUST STS.
BEGINNING TODAY
The Reduction in Residence Rates Becomes Effective
After the monthly use of 7 kilowatt hours for each active room, the excess consumption will be billed at the rate of 3c per kilowatt hour less 5%, or a net rate of 2.85c per kilowatt hour.
This low rate will permit the economical use of all kinds of labor-saving, convenient and comfort-giving household electrical appliances; it makes possible the use of the
ELECTRIC COOKING RANGE
WITH ITS ADVANTAGES:
Cakes and bread after baking are moist.
Saves loss of weight in meats when roasted.
Stove is easily cleaned and kept clean.
No matches.
No odors.
No danger.
Requires little space.
Electric oven retains heat long time when wanted.
Steady heat.
Actual tests in a family of four persons demonstrated that electricity will do all cooking and baking in a superior manner with the use of 111 kilowatt hours monthly, or a cost of $3.16 per month net.
A test using electric ranges for cooking by 72 families demonstrated an average use of 88 kilowatt hours each per month, which at net rate of 2.85c per kilowatt hour, would be an average monthly bill of $2.50.
ELECTRIC RANGES ARE GUARANTEED
Visit our Electric Stores and see our display of Electric Cooking Ranges and other appliances. Demonstrators will show you and explain.

Range Advertisement of St. Louis Company Which Brought Results.

An Electric Range Advertisement that Sold 22 Ranges.

Coincident with the reduction of rates of the Union Electric Light & Power Company, of St. Louis, Mo., a campaign was inaugurated to give greater impetus to domestic electric cooking, the net rate for the average customer being but 2.85 cents per kilowatt-hour.

The accompanying advertisement which was published in the St. Louis papers for September 15, was the first step in the company's campaign and the results from this single publicity effort indicate that the electric cooking load will form an important part of the company's business in the future.

Commenting on the results from this advertisement, C. E. Michel, manager of the office sales department, says:

"The results achieved, while not of very large proportions, were satisfactory, when it is considered that this is the first time in our history that we have made any effort to promote the sale of electric ranges. The advertisements resulted in orders for 22 ranges during one week's time, ranges placed on trial and customers agreeing to pay installation charges, providing they decided not to keep the range at the end of the trial period. At least ten of these trials will result in sales. and since the trial period closed we have received orders for about five ranges on straight sales."

Sale of Municipal Plant Proposed.

The town of Hull, Mass., is considering the sale of its municipal electric plant and has received an offer from the Weymouth Light & Power Company for its purchase, at $115,311, with a proposition to furnish street lighting for $9,483, and public building lighting at $816 per year. The Weymouth company would keep the Hull station in reserve as an auxiliary.

The Hull plant consists of three boilers, with total of 500 rated horsepower, four engines totaling 895 horsepower, and four generators with an aggregate capacity of 955 kilowatts. There are about 1,600 poles set, and 826,000 feet of wire. For the year ended June 30, 1914, 629,450 kilowatt-hours were generated, of which 76,382 were sent out for street lights and 346,632 sold to commercial csutomers.

Municipal arcs numbered three units; incandescents, 581; commercial lighting load was 1,585 kilowatts and power load 297.5 kilowatts. The plant is the least successful of the municipal lighting undertakings in the state, in 1914 showing a loss in operation of about $50,000. The town is chiefly summer residential, it being located on the sea coast.

Commercial Engineering Course for Central-Station Employees.

The Commercial Section of the National Electric Light Association, through its Committee on the Education of Salesmen, has instituted an educational course for employees of member companies. The object of the course is to assist those connected with central stations, who either are already associated or contemplate association with the commercial end of the business, to keep pace with the rapid development in the uses of electricity so as to enable them to prepare for advancement. The course as laid out comprises 17 lessons, which are given by correspondence, supplemented by local class meetings, usually of company sections. One lesson is given each month for a period of 17 months. The tuition is $12, payable in advance.

The first six lessons deal with selling, taking up salesmanship; selling campaigns; locating and following up prospects; advertising; merchandising; relations to customers. Then follow two lessons on meters and metering and on rates. The next six lessons deal with the subject of lighting, as follows: Illuminants; comparative costs of different illuminants; the principles of illumination; lighting practice in residences, theaters, stores, factories, streets, etc.; electric signs and display lighting; wiring. The last three lessons deal with power subjects as follows: Motors, steam, gas and oil engines; isolated plants. The chairman of the committee in charge of this work is Fred R. Jenkins, 72 West Adams Street, Chicago, Ill.

Electrical Construction

Meeting of Wiring Committee of National Electric Light Association.

The Committee on Wiring of the Commercial Section of the National Electric Light Association, of which R. S. Hale is chairman, held a meeting at the Mohawk Club, Schenectady, N. Y., on November 12, at which 15 members were present. The following business was transacted.

Bare Concentric Wire.—The first business was to inspect the board of fittings for the bare concentric wire, as manufactured by the General Electric Company. Circulars with the prices of the fittings were shown, and Mr. Sargent stated that these would be sent out on request, but that instructions had been given to solicitors not to solicit any business.

The question of having the Underwriters' Laboratories make a report on the fittings was referred to Mr. Sargent and the General Electric Company for such action as they thought wise.

The question of further action by the sub-committee of the Electrical Committee of the National Fire Protection Association was brought up, and the matter was left that Mr. Sargent should report to that committee that the General Electric Company had the fittings ready.

The question of the further promotion of the bare concentric wire was discussed, and it was the idea that the central station should attempt to guide the matter so far as proper so as to keep the work in the hands of only competent workmen.

The question of other manufacturers making the fittings was spoken of, and it was the opinion of the committee that it should be made clear that the General Electric Company had been doing the various development work in response to the request of the committee and that the committee hoped that other manufacturers would do likewise, also that the committee intended to co-operate with any other manufacturer that would come forward, just as it had co-operated with the General Electric Company.

Solid Neutral.—Mr. Sargent reported that through misunderstanding the Sprague Electric Company had prepared a panelboard especially designed for use with bare concentric wire, but had not arranged for using a solid neutral on ordinary installations, and that after this had been cleared up there had not been time to prepare the board showing how the solid neutral would be used with ordinary installations. He said that the company would go ahead and make up such a board and prepare a bulletin giving the prices, etc., for panels for different numbers of circuits, similar to the ordinary bulletin, so that a wireman could order a panelboard for a solid neutral as easily as he could order the old kind.

The idea was that the members of the committee would then use these bulletins in calling to the attention of the wiremen in their districts the saving that could be made by the use of the solid neutral.

Standardization of Plugs and Receptacles.—The chairman reported on the meeting of the manufacturers October 25, and read a letter from Harvey Hubbell Company. It was then voted as follows: "The committee being strongly in favor of standardization, is glad to note the report of progress in that direction on the part of manufacturers of plugs and receptacles, and hopes that the sentiment already started will bear fruit in the near future."

Safety Code.—The chairman reported at some length on the conference of electrical interests held in New York in regard to the Safety Code that had been prepared by the Bureau of Standards, stating his opinion that such a code would ultimately be established, and that he thought it best for the interests affected to co-operate to make the code as good as possible.

Cushing's Manual.—The chairman stated that arrangements had been made with Mr. Cushing to continue the chapter on House Wiring in his book to be published with co-operation of the committee. Mr. Cushing will receive suggestions as to the revision, make the revisions and submit the matter to the committee for its approval. It was voted that after this is done the chairman should appoint a sub-committee to take action on the matter submitted.

It was also voted to request Mr. Cushing to include in his publication a short chapter describing the bare concentric wire, with such statements as Mr. Cushing might feel necessary to show that the wire had not been approved by the code for general use, but had only been referred to a sub-committee to obtain further field experience.

Color of Neutral Wire.—The chairman stated that he had received a communication from the manufacturers of wire to the effect that they preferred to have the colors black and red rather than black and white.

Wallace Clark, of the Wire Department of the General Electric Company, who was present by invitation, stated that the reason was that the white wire was more likely to get dirty during manufacture, and might require some slight extra expense in a few cases. He stated that at one time the company had been charging fifteen cents a thousand feet more for white wire.

Mr. Davenport, of Providence, stated that black and white were the colors used in Providence for a long time, and that they had proved very satisfactory, and he thought that red would be by no means as satisfactory. Members of the committee generally expressed themselves as in favor of black and white as better than black and red.

The committee voted that in its opinion the potential-carrying wire should always be black, and that the neutral wire or grounded wire should be readily distinguished, and that the committee preferred a color that was essentially white.

The matter was then left that each member of the committee should consult the wiring contractors, etc., in his city, and also the jobbers, so as to get an idea of what would be the best decision, and should advise the chairman of the results. The idea of this is that such a report from each member of the committee, whether it is unanimous or whether some of the reports are in favor of red wire, would be a much safer basis for a decision than a resolution by the committee.

In the same way it was understood that Mr. Clark should get similar opinions from the manufacturers, finding out from them what actual troubles and costs they have had from such shipments of white wire or red wire as they had made in the past.

Standardization of Both Ends of Portable Cords.—The question of standardizing the end of the cord that would be attached to a flat-iron or other device was brought up, and the committee voted that it recommend that this should be done, so that any cord for use with devices of 660 watts and under could be used with any of such devices. The committee also voted that it *suggested* that this standardizing should adopt the same form of plug as the plug on the other end of the cord to be attached to the lamp socket.

The chairman was requested to take this matter up with the manufacturers.

Miscellaneous.—The following questions were brought up and discussed generally to the advantage of the members, but it was considered that they were not matters on which the committee should taken any action at the present time at least:

Service location and proper notification to wiremen.

Licensing contractors.

City ordinances.

Kansas City Contractors.

The Electrical Contractors' Association of Kansas City, Mo., has decided to hold a business meeting one evening each week at the headquarters of the Builders' Association, with which the electrical contractors have recently affiliated. A program of educational discussions is being prepared and it is expected that many of the problems of the electrical contractors will be thoroughly talked over and solved to the benefit of all. The members believe that in no other way will prices and conditions be bettered. Conditions in Kansas City, as in many other cities, have been such that unintelligent competition and ignorance of proper methods of obtaining costs have made it hard to maintain high standards.

Heretofore the contractors have been meeting together at noon on Saturdays at the Kupper Hotel. The spirit of cooperation prevails to a great extent. The secretary, A. J. Burns, is one of those who have been instrumental in forming the local Builders' Association, which occupies spacious and comfortable quarters on the second floor of the Midland Building. The association has for its purposes the promotion and protection of the interests of its members and the maintenance of just and equitable treatment in their relations with each other and with their employees. It aims to further the educational, social and fraternal interests of its members and of the building trades generally. W. L. Hutchinson, first vice-president of the National Electrical Contractors' Association, is another one of the leaders in this movement.

The president of the Kansas City Association is A. P. Denton, who is a hard and enthusiastic worker and has shown wonderful ability in holding his organization together during one of the most trying years in its existence.

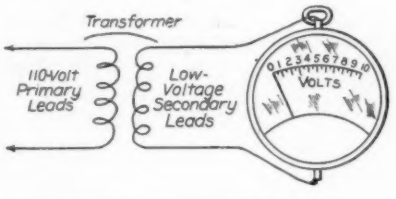
There will be a general meeting of all contractors of Kansas City, Mo., on Monday evening, December 6, at which time George W. Hill will speak on the subject of contractors' accounting and the problems of the mechanical contractors, based upon his experience in traveling among them in the interest of better conditions.

A Cheap 110-Volt Alternating-Current Voltmeter.

A very cheap voltmeter, for use on 110-volt alternating-current lighting circuits, may be made in a short length of time for as low as $2.40, by purchasing a bell-ringing transformer, primary 110 volts, and secondary about 8 volts, and a pocket voltmeter of the battery type. The pocket voltmeter must be one of such construction that its operation depends on a solenoid attracting a movable core which is attached to the needle. One that depends for its operation on a permanent magnet will not do, as this type of construction will not permit the meter to operate on alternating current. The full-scale reading of the voltmeter should be about 10 or 11 volts.

After getting the different devices, it is then a matter of making the proper connections, which are shown in the accompanying illustration.

A meter of this construction is only good for intermittent service, as it heats up if kept on circuit more than a few minutes at a time. A meter of this combination can be made to take up a very small space as small transformers are made for ringing bells that will fit into an ordinary switch box, and also other types that are not much larger than an ordinary socket, being used for lighting automobile lamps from a 110-volt socket. The transformer and meter can be assembled in a small neat box and will be of valuable service to trouble hunters and experimenters after being calibrated for 110 volts. Other voltages will then be in proportion to the calibration as originally marked on the meter dial.



Extending Range of Voltmeter.

The writer has a practical model which is giving good results in connection with experimental work. The meter is almost dead beat in its action.

Alfred E. Oswald.

Driving Belts.

Most users of dynamos and motors have experienced belt troubles either from breaking, slackening or slipping. Good belts should be made so that when a joint is made while the belt is in its place, it ought to present the appearance of an endless belt. After having been taken up once or twice during the first year, good belts, such as should be used in these cases, require very little attention (with the exception of being kept clean and lubricated) during the subsequent years of their long life. If the belt is running in a warm engine room it ought to get a coat of Currier's dubbing three times a year.

All belts having much work to do ought to present a clammy face to the pulley, and this condition is best maintained by applying one coating of dubbing and three coatings of boiled linseed oil once a year. This oil oxidizes and the gummy surface gives the belt a smooth, elastic driving face. A belt looked after in this way will run well slack and the wear and tear will be inconsiderable. On the other hand, dry belts have to be kept tight, otherwise they slip and refuse to do the work. This friction between the driving pulley and the belt "burns the life" out of the belt as long as the slipping goes on.

As to which side of the leather should be placed next the pulley the following may be said: It is well known that by running the grain or smooth side next the pulley, there is considerable gain in driving power. However, by using boiled linseed oil, as before mentioned, the fleshy side will become as smooth as the grain side in a short while, and the driving power will be fully as good. A belt working with the grain side next the pulley really has a much shorter life than the belt running on the flesh side. The reason is the one is working against the natural growth of the hide, while the other is working according to nature. If you take a narrow cutting of belt leather, pull it well, and lay it down, you will at once observe that it naturally curves flesh side inwards. Nature, therefore, as a teacher, tells us to run the flesh side next the pulley, and practice proves this to be correct.

Whether the belts are new or old, a properly made joint is of the first importance to all users of belting. A well-made butt joint with the lace holes punched in a row of diamond shape, answers the purpose fully as well as any. Care should be taken that the holes do not come in a line across the belt, as this weakens the belt considerably, especially where the holes are fairly close together. A good lace, however, properly applied, will last a long time and will cost but little. If a lap joint is made, time should be taken to thin down the ends of the lap. Joints of this sort should be made to the curve of the smallest pulley over which the belt has to work.

Dust should never be allowed to gather into a cake on the pulley or the belt, for if it does, the fiber of the leather gets very much strained. The belt is prevented from doing its work because this stranger defies the at-

tempts made by the belt to get a good hold of the pulley. Therefore good belts lubricated carefully and run as slack as possible without slipping, give good service. Tight, dry belts are not so economical, because the bearings get hot, which makes the shafting harder to turn. Such belts will leave the pulleys or possibly break, or slip so as to endanger its life. If an accident happens because of the belt coming off, or breaking, those in charge will take up time consulting as to what should be done. Meanwhile the cause of the trouble gets time to cool, and the source of annoyance is never discovered. Before a new start is made, the bearings are well lubricated. All goes smoothly, yet someone is blamed for the breakdown.

The above hints should be valuable to those who, though constantly using driving belts, may be unacquainted with the principles of their action.

William T. Estlick.

Window Displays.

Work your windows steadily. Change their dress frequently, daily if need be, and change it so materially that they cannot be recognized. Keep constantly changing their appearance, so as to make them attract, and do not lose that big percentage of passersby who, having once become accustomed to your display, never give it a second glance, even though it be months afterwards. Make people go out of their way to see your window. Make them expect changes and then do not disappoint them. Work your window hard and persistently, but don't overwork it by crowding your displays.—*Electrical News.*

Among the Contractors.

F. A. Clegg & Company has been awarded the contract for the electric wiring installation, etc., in the Louisville Salvation Army Citadel, which is being constructed at a cost of $25,000.

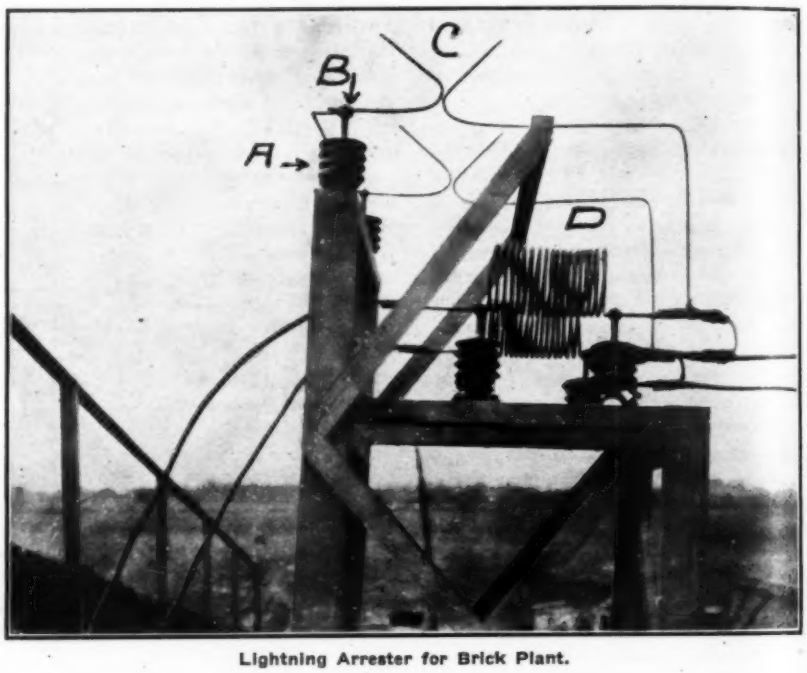
The Nashville (Tenn.) Machine Company has been awarded the contract for the electric wiring of the new West Nashville school building, which is under construction.

The Kaw Valley Drainage Board has let the contract for the 1,000-horsepower electrical installation on the dredge to be used in clearing the channel of the Kaw River, to the Squire Electric & Construction Company, Kansas City, Mo. There will be a 750-horsepower motor on the dredge, and smaller motors on other pumps and on the cutter and drums for handling the suction apparatus. The dredge probably will be put into operation during December.

Lightning Arrester for Brick Plant.

In a large brick plant, of which I am the electrician, the power circuits are 250 volts direct-current, and are installed for the most part on poles between the various buildings, and also on top of the buildings. They are exposed to the antics of lightning, which is very severe in this locality, probably on account of the plant being situated just below the Lachine Rapids of the St. Lawrence River.

Having had considerable experience with lightning arresters of various kinds for alternating current, I decided to construct a horn-gap arrester with choke coils for installation on a feeder supplying various motors in the plant. The accompanying illustration shows how it was built.



Lightning Arrester for Brick Plant.

A is one of six 2,500-volt busbar supports which were available.

B is the adjustable end of the horn gap. This can be slid in or out, according to requirements.

C is one pair of horn gaps, which were set about one-quarter inch apart; when the photograph was taken the gap was purposely increased to show it clearly.

D is one of the choke coils, which were bent up of bare copper wire.

The supporting frame was made of wood thoroughly painted with good weatherproof paint.

The adjustable ends, *B*, of the horn gaps are tied together and thoroughly grounded.

This equipment was installed on the power-house roof, and has acted remarkably well during the severe storms of the past season.

A. P. Broadhead.

Methods of Electrolysis Mitigation.

A paper giving a brief general statement regarding electrolysis and corrosion, and presenting a detailed discussion of the various methods of electrolysis mitigation that have been proposed or tried for protecting underground structures, has just been issued by the United States Bureau of Standards. Methods of mitigation are treated under two heads, namely, those applicable to pipes and those applicable to the railway return system. The conclusion is drawn that while certain of the methods applicable to pipes, particularly pipe drainage and insulating joints, are often valuable, they should in general be used as auxiliary measures only, the chief reliance being placed on reducing potential drops in the railway return to reasonably low values. Where return feeders are necessary for accomplishing this, insulated feeders are preferable, because more economical.

In the last chapter there is presented a discussion of the principles on which regulations concerning electrolysis mitigation should be based, and the responsibilities of owners of underground utilities as well as of the railway companies are emphasized.

Copies of this publication (Technologic Paper No. 52) may be obtained without charge from the Bureau of Standards, Washington, D. C.

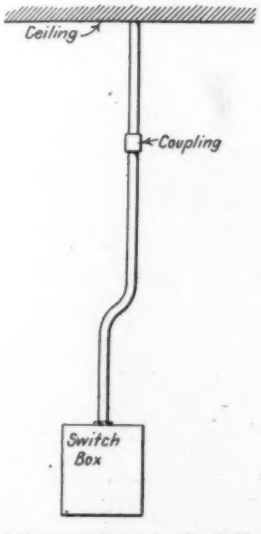
Corundum mining in the United States has ceased, while Canadian production dropped from $239,091 in 1912 to $72,176 in 1914. Artificial abrasives made in the electric furnace have displaced the natural products.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Adjusting Conduit to Switchbox.

On conduit work, when extending conduits to switch outlets in walls and partitions, I find that by bending an offset in the conduit near the box the setting of the box is facilitated. The box will then not tend to pull away from the wall, as is the case when conduits are brought down straight and



Adjusting Bend in Conduit.

sprung into place. The accompanying illustration shows this bend. The pipe may be turned with a wrench and the box adjusted to the exact position desired.

J. H. Lamoureux.

Instrument for Testing.

In a recent issue one of your contributors showed a scheme for connecting ammeters and wattmeters in a circuit, which requires a dead fuse for each size of block to be tested. For many years I have had occasion to do testing on live circuits and preferred to do so by twisting the instrument leads to the contacts at the top and bottom of a fuse block which is in service. The instrument thus forms a jumper over the fuse when the meter is in circuit. The fuse itself acts as a switch to be left closed in its usual position when the meter reading is not required, as in starting alternating-current machines. By removing the fuse from its clips the current is sent through the meter. This scheme obviates the necessity of breaking the circuit or shutting down any machine to insert the instruments. It also obviates the necessity of carrying any more equipment than the meter and its connecting cords.

In order to minimize the equipment necessary we have had developed for our own use a combination volt-ammeter having voltage scales of 150 and 750 volts and current ranges of 10 and 150 amperes. This instrument can be used for either direct or alternating current. By using shunts and transformers in addition, any other range necessary may be secured. By using both current and voltage coils at one time it is possible to make a rough test for frequency. This is done by connecting the voltage winding to the line and short-circuiting the current terminals, as the instrument has separate windings for these two purposes. On direct current there is no difference in the voltage reading when the current terminals are short-circuited. With alternating current the reading is altered, being reduced about 5 per cent at 25 cycles, 10 per cent at 60 cycles, and 20 per cent at 133 cycles.

This instrument is inexpensive and its weight is about 5.5 pounds, which makes it very convenient for general testing.

W. M. Price.

Static Shocks From Belts.

While installing lamps in a machine shop I was annoyed by severe static shocks while I was working around the belts. Immediately over the pulleys ran a water pipe and from this I suspended a copper wire until it reached about a half inch above the belt. The wire carried off the static charge and no further annoyance from static was experienced during the installation.

Arthur H. Terry.

Bushing in Canopy.

In various conduit box covers and brass canopies a standard hard-rubber socket bushing is installed for cord to pass through for drops. Many of the covers are drilled and tapped the proper size to take the bushing, but many times it is necessary to drill the covers, and canopies especially. As they are of such thin metal they cannot be tapped, and where locknuts of the proper size to secure the bushing are not at hand, I find that by holding a lighted candle or match on the bushing, on the inside of the canopy or cover, it can be made soft and pressed all around and made secure and firm, so that it cannot come out.

Otto Weber.

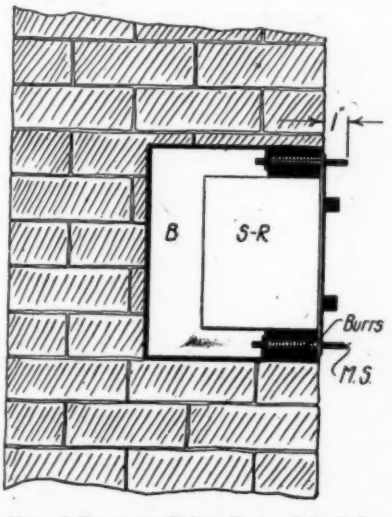
Testing Fuses.

When testing fuses on a motor branch of a 220-volt, three-wire circuit with a grounded neutral, it is common practice to use a 220-volt lamp. As these lamps are special and seldom on hand, a 110-volt lamp can be pressed in use by testing between ground and one line.

A. Heaney.

Installing Flush Switches and Receptacles.

Where a switch or receptacle box (B) is installed too far behind face of wall and switch or receptacle (S-R) needs to be shimmed out to come even with face, take two 6/32 machine screws (M-S) with heads cut off and long enough to project about one inch outside of wall when screwed into ears in box. Put screws in ears and fill space between box and face of wall with burrs placed on machine screws. Place switch or receptacle in position on screws and press firmly against burrs to hold burrs in position. Take out one of the head-



Use of Burrs to Bring Face of Switch Flush With Wall.

less screws and put in screw of proper length to hold switch or receptacle. Then take out the other headless screw and put in another permanent screw.

Frank C. Petersen.

To Clear Dirt From Molten Solder.

To clear the surface of low-melting-point solders such as the bismuth solders has always been a tedious job and unless the dross is cleared off there is experienced considerable difficulty in tinning. This is especially so with solders melting at 212 degrees Fahrenheit, or lower. I have solved this difficulty by dropping a pinch of resin in the ladle. The dross will immediately clear to the edges of the ladle leaving the surface bright. The surface will remain clear as long as an exceedingly small amount of resin remains in the ladle.

H. E. Weightman.

Public Service Commissions

Conducted by William J. Norton

IDAHO.

Northwest Light & Water Company. Upon the complaint of James H. Taylor, as mayor of the city of Wallace, the Commission has investigated the rates for electric service charged by the Northwest Light & Water Company.

Two valuations were submitted, one for the complainant and one for the company. The Commission, for lack of sufficient funds, did not conduct a separate investigation to determine the value of the property, but took the estimate which appeared to be the more reasonable of the two; or in the case of land, where a number of estimates were submitted, took an average of the values of all the witnesses. The Commission says: "We dislike to have to resort to this method of fixing values, as it resembles too closely the abominable practice of juries in settling difficulties in the jury room."

Accrued Depreciation. The Commission found that part of the plant and equipment had been discarded and could not be included in the estimate of value. The company has set aside a depreciation fund which is sufficient to cover in large part the amount of depreciation in this non-used property. The balance is to be amortized by an annual allowance and considered as an operating expense. An allowance is figured which would extinguish this remaining value within the balance of the life of the franchise. "The Commission feels that this plan is much more reasonable than that of amortizing the remaining value of this non-used property during the balance of the estimated life of the units."

Allowance for Depreciation. "From the reports and testimony of the engineers the Commission finds that the weighted average annual rate of depreciation, based on the straight-line formula, is six per cent of the value of the depreciable property."

Rate of Return. The Commission finds that, taking into account the risks and hazards in the present case, a rate of return of 10 per cent is reasonable. The Commission reaffirms its position as opposed to a fixed rate of return which it set forth in the Sandpoint Water Company case. (Reported in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, November 13, 1915, page 897.) The Commission says: "It must be distinctly understood that the rate of return allowed in this case shall not be considered as the fixed rate of return for all utilities of this character. The rate of return in each case shall be determined after due consideration of the hazard and risk connected with the operation of the utility, the efficiency in operation and economy in management, giving to that utility showing the highest efficiency in operation and the greatest economy in operation and furnishing service to the consumer at the lowest possible cost, the highest rate of return. This policy will encourage the management of all utilities to keep their plants up to the highest point of efficiency, to practice all economy possible in operation, and to reduce the cost of the commodity to the consumers to a minimum."

Taxes. The Commission estimated the value of the property for rate-making to be $107,000. In determining the amount to be allowed for taxes in normal operating expenses, the Commission points out that the State Board of Equalization assessed this property for the year 1915 at the sum of $180,000, and on this the Commission says: "This valuation may be fair, considering what the net earnings of the company have been in the past. If the net earnings of the company in the future do not exceed the estimate made herein, then the valuation for taxation purposes, in no event, should exceed the valuation herein made, and then only when all other property is assessed at 100 per cent of its value. In other words, when the valuation of a public utility has been determined on a scientific plan for rate-making purposes, and a schedule of rates fixed in accordance with such valuation, then that valuation and the valuation for taxation purposes should be practically the same, provided, of course, that all property is assessed at its full value. There is no justice or equity in the practice of assessing boards for taxation purposes in fixing excessive valuations on public utilities where the valuation for rate-making purposes has been determined. In case an excessive valuation for taxation purposes is made, the burden will eventually fall directly upon the customers of that utility."

Purchase of Current. It was urged by the complainant that the entire generating plant and equipment and the water rights should be eliminated from the value of the plant for the reason that electric energy can be purchased from the Washington Water Power Company for less money than it costs to generate it at the company's plant. The company is purchasing a part of its current from the Washington Company at present. From the Commission's comparison of the cost of generating with the probable cost of purchasing all current from the power company it appeared that the latter would be cheaper provided the present contract rates were reasonable. The Commission says: "In order for this Commission to be justified in discarding this property at this time, it would have to conclusively find that the rate now charged under this contract between the Washington Water Power Company and the Northwest Light & Water Company is reasonable. That presumption might prevail, but this Commission would not be justified in putting into effect such a drastic order on a mere presumption. It is possible that the rates of the Washington Water Power Company will be determined in the near future, in which event, there would be nothing to prevent a further consideration of this matter when the Commission would have positive evidence at its command. There is one particular advantage accruing to the public by reason of defendant generating its own electric energy and that is, less liability of interruption in service. The stockholders of the defendant company invested their money in this enterprise in good faith and at a time when it was absolutely necessary to obtain electricity by means of its own generating plant and, under all the circumstances in this case, this Commission does not now feel justified in ordering it 'junked'."

Rates. The Commission ordered the following rates put in effect for residence and commercial lighting: 10 cents per kilowatt-hour for the first 20 kilowatt-hours consumed per month, 9 cents for the next 30, 8 cents for the next 40, 7 cents for the next 60, 6 cents for the next 80, 5 cents for the next 100, 4 cents for the next 170, 2 cents for the next 500, and 1 cent for all excess, subject to a minimum of $1.00 per month and a prompt-payment discount of 10 per cent.

The rates for general power are made up of a demand or service charge of $1.00 per month per horsepower of maximum demand, and an energy charge of 5 cents per kilowatt-hour for the first 20 kilowatt-hours per horsepower of demand; 3 cents per kilowatt-hour for the next 30 kilowatt-hours per horsepower of demand; and 0.5 cent per kilowatt-hour for

all excess, subject to a minimum charge of $1.00 per horsepower of maximum demand.

Flat rates are also included for residence lighting, sign lighting and special services.

Domestic or commercial cooking service is to be furnished only on a meter basis, with separate meter, at the following rates: 5 cents per kilowatt-hour per month for installations having a connected load under 2,000 watts, and 3 cents per kilowatt-hour per month for installations having a connected load of 2,000 watts or over.

Small heating and single-phase motor appliances may be used on this circuit when the connected load is 2,000 watts or over, but cannot be considered as part of the connected load in obtaining the benefit of this schedule.

Minimum monthly charge under this schedule shall be $1.00 for each meter installed.

INDIANA.

Laporte Gas & Electric Company. The Public Service Commission has approved a contract between the electric company of Laporte and Charles G. Kimble, of Laporte, whereby the company will provide electric current to Kimble, "delivered at the city limits of Westville, Ind.," sufficient to supply the requirements for electric current at Wanatah, Lacrosse, Kouts, Union Mills and Wellsboro. The company is to sell the current at rates which shall be at all times under the jurisdiction of the Commission, according to the order. The rates, which are at present approved by the Commission, range from four cents to two cents per kilowatt-hour, plus a readiness-to-serve charge of $1.00 per month per kilowatt of maximum demand. If bills are not paid promptly, one-half cent per kilowatt-hour for all current consumed during the month is to be added.

NEW YORK—Second District.

Paul Smith's Electric Light, Power & Railroad Company. The Second District Commission has approved an agreement between the village of Lake Placid and the Paul Smith's Company, under which the municipal electric plant operated by the village will be connected with the company's system. The municipal plant has become inadequate, and additional current brought from the company's generating plant in the village of Saranac Lake will be purchased to make the supply adequate.

The Northern New York Utilities, Incorporated, was authorized to issue $76,700 par value of securities to finance extensions and improvements of its system in and about Watertown. The company will issue $55,000 par value of its five-per-cent, 50-year first mortgage bonds at 87.5, to net $48,562.50 and $21,200 par value of its seven-per-cent cumulative preferred stock at par.

PHILIPPINE ISLANDS.

The Philippine Railway Company. A complaint was brought before the Board of Public Utility Commissioners of the Philippine Islands, which called in question the right of a public service company to engage in collateral business undertakings. (Strachan & MacMurray, et al. v. The Philippine Railway Company, September 15, 1915.)

It has been the practice of the railway company to take a certain amount of outside work in its machine and lumber shops, which has brought it in competition with the complainants. The complaint sets forth that the railway company has been able to engage in such business at prices which the complainants cannot possibly meet, and that the railway company is favored by the government's guarantee of four per cent on its original investment. The Commission discusses the different phases of the situation presented, and concludes:

"Although the defendant company is not expressly authorized, either by its franchise or by its articles of incorporation, to engage in the business mentioned, yet, considering that it is not prohibited from doing so, and that it is, on the other hand, advisable and profitable for it to engage therein, we hold that this is included among its incidental powers implicitly authorized by its franchise to enable it to successfully manage its affairs, because the defendant company has engaged in the business mentioned for the sole purpose of making temporary use of the parts of these shops which at times it does not need in connection with the operation of its railways, in order to use the portion of its property so lying idle in such manner as to produce gain or profit which is a right that every corporation is acknowledged to possess as one of its incidental powers for the proper and suitable administration of its property. . . .

"From the legal point of view the defendant company has, therefore, a perfect right to continue doing commercial work in its shops, as it has been doing until the present, regardless of whether in doing so it competes with the local shops of Iloile and Cebu, because the factor of the competition must not be considered in the determination of such right, competition being always advantageous to the public as a regulator of reasonable rates and being an ordinary and current thing in ordinary business and in all business authorized by general legislation. As to the government guarantee invoked by the petitioners, the same is also a factor which does not enter into the consideration of the present case, because the government cannot, despite its guarantee, deprive the defendant company of the right to manage its property as the head of the family ought to manage that entrusted to his care. . . .

"It is evident that the defendant company has a right to engage in the lumber business as set forth, without any limitation other than that this shall not interfere with the operation of its railways, and it is in this respect only that the business referred to is subject to the control of this Board."

Utility Commission Created in Canadian Province.

The Province of Alberta has just created a utility commission consisting of three members. It will exercise a general supervisory control over all public utilities in Alberta, and also act as an advisory board on municipal improvements involving bond issues. The chairman receives a salary of $7,200 and each of the other members $6,000. This utility commission is unique in the Dominion of Canada.

Proposed Revision of Rules of Practice of Patent Office.

Commissioner of Patents Thomas Ewing has proposed a considerable number of amendments to the Rules of Practice of the United States Patent Office to go into effect January 1, 1916. These amendments cover over six pages of the *Official Gazette* in the November 9 issue of which they were published. A number of the old rules relating to caveats, being now obsolete, are abolished; the other amendments are proposed to correct certain inaccuracies in the present rules and to bring about certain needed reforms in the practice of the Patent Office. Mr. Ewing announces that he will consider any further suggestions on this line that are submitted to him before December 10.

Water Power in Vermont.

United States Senator W. P. Dillingham addressed the Burlington (Vt.) Merchants' Association, November 11, on the water powers of the state. He pointed out their great value, saying that if one-half the two million horsepower that engineers estimate are now running to waste were utilized for industrial purposes, something like $250,000,000 of distributed wealth would be added to the state, as each horsepower used in manufacturing in the United States represents $248 paid to labor and $1,152 in the value of the goods produced.

Questions and Answers.

All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within ten days of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.

Questions.

No. 315.—Motor-Driven Motion-Picture Machines.—About what percentage of our large cities having over 100,000 population permit the use of motor-driven motion-picture machines?—S. P. L., Topeka, Kans.

No. 317.—Wiring for Electric Ranges.—In wiring an apartment building for electric ranges, each of which has a maximum possible load of two kilowatts, what is the best arrangement of the special range circuits so as to economize wire and reduce the voltage drop to the minimum? Meters to be in the basement.—D. A. T., Chicago, Ill.

No. 318.—National Electrical Code Changes.—On what date do the changes made in the National Electrical Code every two years go into effect? I have been told it is on January 1 following the year of revision; others have told me different dates and I have even been told there is no fixed date—C. C., New Haven, Conn.

No. 319.—Center Suspension of Street Lamps.—In what cities in this country, if any, is there used to any extent the system of suspending street lamps over the center of the street by means of cables between the opposite houses, no posts at all being used? This method is very successfully used in London and some other European cities, but to my knowledge little or not at all here. What is the objection to it?—P. N. V., Albany, N. Y.

Answers.

No. 311.—Simple Rate System.—Has any system of rates for residence customers of a central station ever been devised which, though based on actual or assumed maximum demand and including primary and secondary rates for, say, 30 hours' use of this demand, can be fully explained to any customer without using the words "30 hours' use," "demand" "maximum demand," or even "kilowatt-hours?" If such a simple system is as yet too ideal, what is the nearest approach thereto that has been attained?—W. H. T., Ann Arbor, Mich.

Perhaps no subject has received so much attention in recent years as that of rate-making, and the reason for this is because it is coming to be better understood that many existing rates are illogical. There are an endless number of rates in existence, varying from the simple charge of so much per kilowatt-hour to that which takes into consideration a charge for service, plus a charge for actual energy used—the rate for which depends upon the class of service, whether lighting, power, cooking, etc.—plus modifying clauses governing such matters as maximum demand, load-factor, power-factor, and whether the load overlaps the peak or is off-peak load.

A logical rate is necessarily complex and rate-making abounds with intricateness; it may be said that the more logical a rate is the more complicated will it be. This statement is rather loose, and, like all generalities, may not be strictly true to any and all cases without some modification. However, it is safe to say that the more thought given this matter of rate-making the more complicated are the schedules, which usually means the larger the company the greater the variety and the refinements used in setting its rates. This does not necessarily mean that the customer's bill is more complicated, because in many cases it is possible to estimate within close limits the conditions obtaining from other similar installations. Thus while the statement of the bill may be comparatively simple, the means of obtaining it is far from being so. Rate-making is a science in itself—a fact not recognized until quite recently. That this subject is one of paramount importance to the electrical industry must be apparent from the large amount of interest being given it by central-station companies and public utility commissions, the latter often setting rates after careful investigation of investment, operating costs, depreciation, etc.

A very interesting paper entitled "Rates and Rate-Making," by Paul M. Lincoln, appears in the *A. I. E. E. Proceedings* for October of this year, and querist is strongly recommended to read it, for it shows that a logical rate can be obtained only after taking into account many factors. In summarizing it is stated, among other things, that: "(1) A logical and just rate for electric service cannot be based on kilowatt-hours alone. (2) Load-factor must be recognized in some manner in order to arrive at a logical rate. (3) In order to recognize load-factor it is necessary to measure both kilowatt-hours and maximum demand." The National Electric Light Association has a standing Committee on Rate Research which is doing a magnificent work in connection with this subject, and the results are chronicled each week in a bulletin entitled *Rate Research*. This bulletin contains information pertaining to rates, public service regulation, etc., and is a compendium of extremely valuable information. There are many books dealing with the several phases of rate-making, and to these querist should refer, because it would be impossible to cover any one of them here.—K. R., Chicago, Ill.

No. 314.—Talking Signs.—What means are used in electric "talking" or word-spelling signs to prevent injurious arcing at the contacts where the current is continually changed from lamp to lamp?—A. F. B., New York, N. Y.

At the present there are found on the market a great many different types of so-called talking signs and it can be said according to their characteristics they may be put into two distinct categories: (1) The kind where the letters or words are flashed "on" one after another for short, steady intervals; (2) the kind where the light-letters and words are traveling continuously across the lamp-field. In the first-named class the disposition is generally such, in order to eliminate the arcing referred to, that the current as a whole is turned "off" just a moment before the arcing on the individual contacts would take place; this is done for various reasons. Even when the mechanical part of the construction is made with all possible care, it is not possible to get such a precision that a few thousand contacts would operate at the same identical instant; this therefore naturally would permit some lamps to be extinguished sooner or later than others. On the other hand, during the period of changing the word or words and consequently the grouping of lamps to be lighted next, it would happen that intermediate lamps would be lighted, which would result in considerable confusion of lighted lamps, until the final group was fully in action for the next word. This is the main reason why the general circuit is broken and not the individual one of each lamp contact, with current flowing. In some types of these devices there exists one set of contacts and in others two or more, which are in action alternately; that is, while one flash is visible, the next is in preparation, and if the main current were not broken between the flashes great confusion would arise. It is therefore obvious that the numerous contacts and brushes are not subject to any arcing at all and are good for a long time. According to the particular construction they are subject to more or less wear and tear, through friction against the part their springy effect works, during the time no current passes.

The second class referred to is entirely different in its main principle; here each individual lamp is lighted many more times than in the former

class and it may be said that the contact-making and breaking as a whole is about thousandfold in proportion. As there are two different methods of obtaining the same effect for word-spelling signs it will be interesting to know the elements used in each kind. One way is to make a member of some sort of insulating material travel under the brushes, or between the brushes and the common return pole; this member has in this case holes or slots where the brush enters while passing and makes the lamp light up. Here naturally an arcing is produced when the current is closed and when same is opened, which consequently must affect the member more or less during the time it is used. But as the current is rather feeble the arcing is of not much harm to it. The other type is where the common pole is represented by metallic letters which travel across the brush sections and each individual brush works as a simple single-pole switch. Here it is advisable to let the whole be submerged in an insulating oil basin, which will minimize the arcing and entirely kill it, besides it will provide for longer life of the elements at work, as the friction is reduced by the effect of the oil between the metals. In this class of sign in which the words and letters seem to travel across the entire sign by successively lighting up neighboring letters, the speed of motion is limited by the definite time interval required to light up each individual lamp to full brightness. This also tends to decrease the arcing.—G. F. B., Chicago, Ill.

No. 316. — PROTECTING LIGHTNING GROUNDS.—What is the best method of protecting lightning rods and the ground wires of lightning arresters where the wires are exposed to injury near the ground? I understand that iron pipes are objected to by some authorities.—L. F. B., Wilmette, Ill.

A ground wire or rod may be protected for either of two reasons, or both. A wire may be protected to prevent objects coming in contact with it, and thereby suffering possible damage; or it may be protected, itself, against damage from external causes. The first of these is usually accomplished by using insulated wire, weatherproof or rubber-covered, according to circumstance; the second by covering the wire with a separate sheathing. This sheathing may be of wood or of metal, depending upon the conditions that prevail or are to be expected.

Usually a ground wire is covered with wooden beading as it goes down the pole to earth, and this beading is fastened to the pole by staples driven into the pole at suitable intervals. This wooden covering should extend from below the ground level to eight feet or more above. Where poles are jointly used by two or more companies it is well to extend this covering up to the full length of the ground wire. In running a ground wire down a pole it should always be installed on that side of the pole which is not used for the linemen's climbing irons; in this way it will not be so liable to suffer damage nor interfere with the men at their work.

Where a ground wire is liable to be damaged by wagons, and other similar objects, a metallic covering is often used instead of, or in addition to, the wooden covering. One would, of course, at once suppose that such a metallic casing would seriously impede the flow of current to ground, but experience indicates that under certain conditions the presence of a metallic covering has little effect. At low frequencies, commercial and even considerably higher, surrounding a wire with iron pipe materially increases the inductance of the path to earth, but at very much higher frequencies—the frequencies of lightning—there is little effect resulting from the iron pipe. The reason for this is that eddy currents set up in the iron pipe prevent the magnetism reaching more than a comparatively small value; in fact at one definite frequency there will be no effect whatever due to the iron pipe, whereas at still higher frequencies the inductance will be even lower. This is a matter of academic rather than practical interest, however.

In running a ground wire through a pipe care should be taken that the ground resistance of the earth wire be not higher than that of the iron pipe, otherwise the lightning discharge is liable to jump to the pipe. The same thing occurs when the iron pipe is not grounded.

Protect a ground wire with wooden beading wherever it suffices, but where safety to the public or the system requires use an iron pipe. Ground wires should always be insulated, weatherproof wire being satisfactory for pole work.—K. R., Chicago, Ill.

Auxiliary Radio Equipment on Steamer Tested.

A report on the test of the auxiliary radio equipment installed aboard the Merchants & Miners Transportation Company's steamship *Howard* has been made by the United States Bureau of Navigation. This test was made because of the difference of opinion and the absence of any official information as to whether or not certain types of auxiliary apparatus and their sources of auxiliary power supply fully comply with Section 1 of the act of June 24, 1910, as amended July 23, 1912.

The United States Department of Commerce believes it to be necessary that the various types should be officially submitted to tests from time to time, to furnish the desired information. The test on the steamship *Howard* was conducted from July 13 to 19, 1915, en route from Norfolk to Boston, and return from Boston to Baltimore, by F. A. Kolster, of the Bureau of Standards, and R. Y. Cadmus, radio inspector of the Bureau of Navigation.

The Edison battery installed on the steamship *Howard* consists of 100 cells type B-4-H, W. S., rated at 80 ampere-hours. This battery supplies power to run a 110-volt motor, which drives the 0.5-kilowatt, 500-cycle generator of the radio transmitting equipment, and also supplies power for 25 or more deck lights. The voltage of the battery when fully charged is 140. It is necessary, therefore, to have a resistance in series with the battery in order to cut down the voltage at the terminals of the motor to 110. The resistance supplied for this purpose is adjustable, so that as the battery voltage gradually drops the voltage at the motor terminals can be kept at 110 by decreasing this resistance.

One test of the battery was made, using only 90 instead of 100 cells. The initial voltage of these 90 cells after charge was about 125. No resistance was used in series.

The Bureau states that the 90-cell battery apparently meets the four-hour and six-hour service requirements of the act of June 24, 1910, amended July 23, 1912, and the London International Convention, respectively.

The motor-generator set furnished with this equipment is of the inductor type. The radio transmitter furnished is of modern design, efficient, and easily operated. Provision has been made for the use of wave lengths of 300, 450 and 600 meters. The transmitter may be set for any of these wave lengths by means of a simple switch. The antenna current was found to be about 6 amperes for 450 and 600 meters and about 4 amperes for 300 meters.

Under these conditions it is believed that the requirement of 100 miles communication will be fulfilled, as indicated in the range tests conducted while en route from Norfolk to Boston and return to Baltimore.

Manufacturers of Supplies.

A meeting of the board of governors of the Associated Manufacturers of Electrical Supplies will be held at the Hotel Biltmore, New York City, on December 2.

A meeting has been called for December 2, at 3 p. m., at the Hotel Biltmore, by the manufacturers of inclosed fuses to consider the formation of a section, acting under the approval of the board of governors of the Associated Manufacturers of Electrical Supplies.

A Method for Measuring Earth Resistivity.

A knowledge of earth resistivity may be of value in determining something of its composition, such for example as moisture content, whether or not it contains oil or ore of high conductivity, etc., or in the calculation of damages to pipe systems by the return current of street railway systems.

For those cases in which we desire the resistivity of a fairly large portion of earth, extending to a considerable depth, or where there are reasons why the measurement should be made without disturbing the portion to be measured, the following method is suggested by Frank Wenner in the *Journal of the Washington Academy of Sciences.*

Four holes are made in the earth approximately uniformly spaced in a straight line. The diameter of the holes is not more than 10 per cent of the distance between them and all extend to approximately the same depth, which is usually that at which we are most concerned with the resistivity. In each hole is placed an electrode which makes electrical contact with the earth only near the bottom. Two of these electrodes serve as current terminals and two as potential terminals in the measurement of the resistance.

Knowing the resistance, the depth of the holes and the distance between them we have data from which the effective resistivity in the vicinity can be calculated.

In case a is the distance between the holes, b is the depth of the holes, ρ is the resistivity, and R the measured resistance, then

$$\rho = \frac{4\pi a R}{1 + \frac{2a}{\sqrt{a^2+4b^2}} - \frac{2a}{\sqrt{4a^2+4b^2}}} = \frac{4\pi a R}{n}$$

where n varies between 1 and 2 according to the ratio of the depth of the electrodes to their distance apart.

If the holes are not in a straight line or are not of a uniform depth or spacing the resistivity is easily calculated from the depth of each of the holes and the distance of each from each of the other three.

Concerning the resistance measurements there is in general no need for a high accuracy. There is, therefore, no reason why we may not use an ammeter for measuring the current and a voltmeter for measuring the resulting difference in potential between the potential terminals providing no current is drawn from these terminals. As the voltage to be measured is low and the resistance between electrodes and earth high, errors would be introduced if the ammeter-voltmeter method were used in the ordinary way.

The following potentiometer arrangement, using alternating current to obviate the more serious difficulties which might arise on account of polarization with direct current, seems to answer the purpose fairly well. The current terminals or electrodes are connected to a source of alternating voltage of suitable value, and across the line is connected a step-down transformer, the low-voltage side of which is connected to the ends of a slide wire. One of the potential terminals is connected to one end of the slide wire and the other through a vibration galvanometer to the adjustable contact on the slide wire. An ammeter is connected into a lead to one of the current terminals and a voltmeter across the ends of the slide wire. On account of the polarization at the current electrodes a variable inductance is connected into one end of the leads, for the purpose of bringing the test current in phase with the voltage of the low side of the transformer.

If then adjustments are made so that no current flows through the galvanometer, the position of the sliding contact, the value of the test current, and the voltage across the slide wire are read, we have data from which the resistance R is readily calculated.

From the measured resistance, and the depth and distance between electrodes a value may be obtained for the effective resistivity as explained above. The value depends mainly upon the resistivity in the neighborhood of and between the potential electrodes and very little upon the resistivity at distances from either of these electrodes equal to half the distance between the current electrodes.

So far the method has been used only for determining resistivities in a region very close to the surface, a few meters or less in radius.

Among the Supply Men

The Marketing of a New Electrical Toy.

The toy market at its best is a hard one to break into. The problem is multiplied when a new toy is to be put before the public. The toy in question is the miniature practical electric range which cooks, bakes and broils, just like the full-size types; this Junior range has been described and illustrated in former issues. It is meant to be used as an active part in the nursery tea party, and is so built that none of the embryo cooks could possibly get a shock. The price of $8 is far above the average toy price. This feature hindered the placing of the toy on the market. Yet, there were other factors in favor of it. The boys had their electrical and mechanical toys, but nothing new had been offered for girls since the advent of the sleeping doll.

Another phase of this Junior electric range is that it is an entering wedge for the "Do It Electrically" doctrine, and the educational value of this toy range is not a small factor in the campaign.

The Western Electric Company, which is putting this Junior range on the market, laid two advertising campaigns. The first naturally was an appeal to the electrical trade. A mailing folder was prepared outlining the features of the range and calatoging the sales helps which the company offered free to the dealer who wished to take on this new line. These included newspaper electrotypes, folders, window displays, and small cook books. This folder also offered to send a sample of the toy range for pre-inspection to any central station or other electrical merchants. This direct mail advertising was supplemented by a generous use of full pages in the advertising sections of the leading electrical papers.

To help electrical merchants create a market for this new toy, a comprehensive national advertising campaign was laid, full-page advertisements appearing in such popular magazines as *St. Nicholas,* and half-page advertisements in the *Saturday Evening Post.* This range was also demonstrated at the New York Electrical Show, and formed a part of the equipment of the New York School of Domestic Science exhibit, attracting no little attention.

Electrical dealers throughout the country are going to find the miniature practical electric stove a most popular holiday specialty.

Celebration Features of Electrical Prosperity Week Unique and Interesting.

An entire country awaits the dawn of a most unusual week of electrical celebration. When leaders in the thought and progress of electricity almost a year ago, decreed the elimination of those who cry "hard times" and set November 29 to December 4, 1915, as a six days period of rejoicing and extension of everything electrical, there were those who were skeptical of the plan.

During the long months of tireless work by those who have the management of the campaign there have been many evidences of this skepticism. Overcoming what obstacles that such a campaign was bound to meet, Electrical Prosperity Week, on the eve of its inaugural justly lays claim to the greatest trade-building campaign in America's industrial history. It has had no rivals either in the point of nation-wide participation by interests in and out of the industry or in the co-operation of all branches of the industry to make it a success.

It is bound to achieve a primary purpose of refreshing the minds of Americans with thoughts of the nation's welfare—it has done so already. It began the campaign when dark clouds flitted over the land. It celebrates the Week with the country enjoying unprecedented prosperity in every particular.

It will accomplish all its other purposes. Every branch of the industry will have "sales made" reports to turn in after this week. Every branch of the industry will benefit by the unparalleled education the campaign has embraced within its program. Every man in the industry will have reasons to be proud of the part he has played to speed the dawn of the day when all things will be done electrically. For all times the irresistible strides of the electrical industry and the enterprise of the men at its helm have been established. It is doubtful if any industry in the world could have conceived such a campaign and conducted it along the lines Electrical Prosperity Week has enjoyed.

One has but to examine the character of celebration and the wholesome participation by the public at large in these programs to sense the completeness and the effectiveness of this Week.

Los Angeles, Cal., will be illuminated during the Week as never before. Electrical floats will parade through the streets. The electrical dealers, will take advantage of the "cash-in" opportunities which the celebration will offer, by making attractive displays of their appliances. In a rousing proclamation, read to the Jovians recently, Mayor Sebastian placed himself on record as enthusiastically in favor of the celebration.

San Francisco's downtown district will be transformed into a great white way of light. More than 500,000 pieces of literature have been sent out by the Exposition advertising the Week and calling on all of California to be present on the closing day of the Exposition. On December 1, a Prosperity Ball will be held in the Civic Auditorium; special electrical decorations will be provided.

In Cleveland, Ohio, one of the many features which is attracting attention to the celebration is an essay contest which is being conducted by the Cleveland *Plain Dealer*. From present indications, the list of contestants working for the 42 cash prizes aggregating $145 will exceed the number that have participated in any other previous contest of a similar nature ever held in that city. The subject of the essays is "Electricity in Everyday Life."

Hot Springs, Ark., will have a "Fete Day" and night when there will be electrical displays of extraordinary character. It is also proposed to hold an auto parade with cars beautifully decorated with electrical effects. A "Calathumpian Night" and grand ball will be given with spectacular electrical decorations. The stores of the city will be beautifully illuminated.

Indianapolis, Ind., is planning some unusually attractive features in connection with its electrical exposition to be held during the Week. The show will be highly flavored with the Christmas atmosphere. The exhibitions themselves will be made up of an almost endless variety of appliances for Christmas gifts, and a part of the exposition decoration, which is to be on a lavish scale will include a number of brilliantly lighted spruce trees.

Cincinnati, Ohio, will have an elaborate electrical display on Gilbert Avenue, Viaduct. The exhibition will be held at 8:30 p. m. Saturday, December 4. The latest inventions in electric advertising, illuminating, etc., will be shown. The bend in the Viaduct will provide the most advantageous spot from which to view the spectacle.

Milwaukee, Wis., will stage an electrical show on the first and second floors of the University Building. The first floor will be devoted to the heavier apparatus such as motors and power-plant equipment. The second floor will be devoted to fixtures and household appliances. On Monday, November 29, a formal opening will take place, the doors being open on each day of that week from 10 in the morning until 11 at night. Tuesday has been designated as "housewives' day," Wednesday as "illumination day," Thursday as "Wisconsin day," Friday as "industrial day," and Saturday as "children's day."

Galveston, Texas, will hold an electrical parade which promises to be one of the most attractive events ever held in the city. The parade will be one of contrast—the old being compared with the new. For instance, the old-fashioned method of hauling cotton by mule power will be shown, followed by electric vehicles typical of the present-day, modern method of transportation of such commodities. It is expected that probably 20 electric trucks and some 30 electrically driven pleasure vehicles, besides a few old-fashioned conveyances to effect the contrast, will participate in the parade.

A feature of the parade will be a wireless control. A stationary wireless plant will be placed in the city hall; portable wireless apparatus will be carried at the head of the parade and also in the center of the line, and orders will be issued by radio.

In Pittsburgh, Pa., four miles of downtown streets will be gorgeously illuminated. Prizes will be offered for window displays and bargains will be offered by the principal electrical stores for each day of the Week. One of the big features of the Week will be a monster night parade in which all the electrical jobbers, contractors, manufacturers and central stations will participate. It is estimated that several thousand men will be in line together with large numbers of beautifully decorated floats.

In Asheville, N. C., practically every display window on Patton Avenue, from Haywood to Pack Square, will be used to display the various uses of electricity, as applied to domestic and commercial uses. Competent decorators will be in charge of the arrangements of each window. Another feature of the celebration will be a parade of decorated electric vehicles which is being arranged by the committee in charge. These vehicles, including everything from dainty electric coupes driven by ladies to the big motor trucks which will haul several tons without trouble, offer great possibilities in the way of decorations, and as valuable prizes will be offered for the most artistic vehicles in the parade, a splendid pageant is expected. An outdoor exhibition of moving pictures dealing with electrical subjects will be shown, and illustrated lectures will be given dealing with electrical science in a practical way.

In Dayton, Ohio, seventeen dollars will be offered in prize money to Dayton school children by the Jovian League for the best essay on electricity, as one of the features of the Week. An electric pleasure vehicle sociability run will be held which will wind

up with refreshments at the Dayton Country Club. A special meeting of the Dayton Advertising Club will be held during the celebration at which a lecture upon "Electricity for Advertising Purposes" will be given. The Jovian League of Dayton will hold a rejuvenation and initiation which, for the members of the League, will be the event of the Week.

Denver, Colo., has recently selected a Queen Electra to preside over a big electrical prosperity show to be held in the auditorium. She was selected from among one hundred beauties. Her identity is a secret. No one knows her and not until the opening ball on Monday night, November 29, will her identity be disclosed. On that night before hundreds of people Electra will unmask and thereafter during the week of the electric show will rule supreme over all things electrical. She will radiate brilliancy and electricity, for she will be gowned in an exquisite robe in which will be concealed myriads of small electric lights. Other prominent features of the Week for which extensive preparations are being made will consist of an electric-vehicle parade and electric automobile races. The widespread interest which is being manifested in these events would seem to indicate that they will be of unusual interest. There is also to be provided in connection with the celebration a giant electric flag, 125 feet by 150 feet. This flag is to be made up of red, white and blue electric lights, and will be placed in front of the Gas and Electric Building. The veterans of the Civil and Spanish American Wars are to participate prominently in the celebration upon one day of the week to be known as "patriots' day." The school children will participate in the events of "patriots' day" by singing National hymns.

Elaborate plans are being completed for celebration of the week in Chicago by the Commonwealth Edison Company. Special appliance campaigns will be carried on.

Nashville Jovians Plan Big Celebration.

Elaborate preparations will be made by the Jovian League of Nashville, Tenn., for observing Electrical Prosperity Week. A committee composed of J. Pink Lawrence, James A. Shingleton, A. G. Maddux, L. R. Ritter, J. H. Ansley and James E. Carnes has been named to look after the detail of the celebration locally. As worked out these plans provide for illumination of important buildings, electrical demonstrations and exhibits of a nature that will interest the public, etc. The Nashville Railway and Light Company will co-operate in the celebration, putting up special electric signs and issuing special informative booklets.

Wichita Prosperity Week Plans.

The electrical industries of Wichita, Kan., have prepared elaborate plans for the celebration of Electrical Prosperity Week. There are to be three parades. The first to be held on November 29, at night, consisting of all the officials and employees of the combined electrical industries of the city. The novel features of this parade are that the Bell telephone, Western Union Telegraph Company, street railway and interurban interests are also included. There will also be included a great number of decorated illuminated floats, entered by all local manufacturers and dealers who are also promoting a "Made-In-Wichita" campaign, also about ten decorated street cars, belonging to the Wichita Street Railway. Special street illumination will be provided by means of spans of incandescent lights strung across one of the main business streets every hundred feet for ten blocks, also flood lighting by means of projectors. It is planned during the progress of the parade to turn off the Magnetite arc White Way system and then turn it on again immediately after the parade.

On Wednesday night, December 1, there will be a parade of electric pleasure vehicles, these to compete for two prizes of $25 each for the best decorated and illuminated interior, and the best decorated and illuminated exterior. Second prizes consisting of two Frantz Premier electric cleaners are to be awarded. There are 120 electric cars registered in Wichita, of which number at least 75 are expected to parade.

On Saturday night, December 4, the parade will be devoted to the Jovian Order, which is strongly backing the entire celebration. This will consist of specially decorated floats, carrying the officers of the Order, one officer on each float, these to be decorated in accordance with the character represented. The candidates for rejuvenation to be held on the same night, to the number of 20, will be confined in a barred cage float attended by the balance of the membership attired as Imps and other satellites.

The leading business men of the city have entered into the spirit of the occasion and will compete for specially illuminated and trimmed windows. Cash prizes are offered by the electrical interests to be given to the window trimmers competing. Splendid support has been given by the leading newspapers, especially the Wichita *Beacon*, and there will be a special edition published on November 27, containing five electrical pages devoted to advertisements, and publicity of all local electrical industries. No electrical show has been provided for, as one was held in Wichita the latter part of October, it being a part of the Fall Wheat Show, from which much good publicity was derived.

It is also planned to have an illuminated balloon ascension. The Wichita Aero Club will use its new balloon "Wichita I," and it is hoped that this will be piloted by Captain E. H. Honeywell, of St. Louis, providing the weather conditions are satisfactory. This is to be illuminated with colored lights, arranged on the basket, and the bag proper to be lighted up with several electric searchlights.

The Wichita *Beacon* has also offered three prizes to the ladies of the city writing the best article on "Electric Appliances in the Home."

Electric Steel in Germany.

The total production of electric steel in Germany in 1914 was 90,000 tons and only 5,800 tons less than the total output of crucible steel. Twenty electric steel plants were in operation, 10 having Siemens-Halske furnaces, seven Heroult furnaces, two Nathusius furnaces, and one a Keller furnace. Of these 20 installations, eight are producing high-grade electric steel to supplant crucible steel, and the remaining 12 use the electric furnace to melt ferro-manganese. A number of steelworks are said to be contemplating the installation of electric furnaces. Of a total of 44,000 tons of electric steel produced in furnaces controlled by Siemens and Halske, 34,400 tons were made in induction furnaces, 7,400 tons in Girod furnaces, and 2,250 tons in radiation furnaces. As regards the 12 plants used to melt ferro-manganese, four are of the induction type, three are Heroult and two are Keller furnaces, while one each of the Rombach, Girod and Nathusius types are employed.

New Electrical Companies in Chile.

The Compañia Eléctrica Caupolicán (address: Rengo, Chile,) has been organized with a capital of 800,000 paper pesos (about $130,000 American gold) to take over certain electrical machinery already installed and to purchase the concession for lighting the towns of Rengo,, San Fernandom, Rancagua, Peumo, San Vincente, and eight others.

La Compañia de Luz Eléctrica de Constitución has been organized, with a capital of 60,000 Chilean paper pesos (about $10,000 United States gold), for lighting and providing power to the town of Constitución, located in the Province of Maule, on the coast. Constitución has a population of about 6,500 and is a popular seaside resort.

The addresses of directors in these two companies may be had upon application to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch offices.

LOCATING FAULTS BY THE DROP-OF-POTENTIAL METHOD.

By H. S. Percival.

The location of a circuit fault such as a "short," "cross" or "ground," is usually determined with the aid of a Wheatstone bridge, but if a bridge is not available, recourse may frequently be had to the drop-of-potential method. This method requires only a source of current and a suitable voltmeter, and while the results are not ordinarily so accurate as may be obtained with a bridge, it can be used to advantage in many cases, if the length of the circuit is known.

The purpose of this article is to describe the theory of the drop-of-potential method and to discuss its application in certain typical cases.

Theory.—If a source of direct current be connected to the terminals of a circuit of uniform resistance, Fig. 1, there will be a fall of potential along the conductor, proportional to the current flow and to the conductor resistance. By connecting a voltmeter V across the terminals AB of the circuit, the total fall of potential or "drop" can be read on the instrument, or by connecting the voltmeter, Fig. 2, between one terminal and any point C, along the circuit, the drop in the part of the circuit AC between the voltmeter terminals will be indicated on the instrument. Since the drop is proportional to the conductor resistance, which is in turn proportional to the length, the ratio of the drop over the total length ACB, to the drop over the part AC, is equal to the ratio of the total length of the conductor to the length of the part, viz:

$$D:d::L:X \qquad (1)$$

where

D = deflection when drop is taken over the total length $A\ C\ B$,

d = deflection when drop is taken over $A\ C$,

L = total length of the conductor $A\ C\ B$,

X = length $A\ C$.

Stating the proportion (1) in the form of an equation, we have:

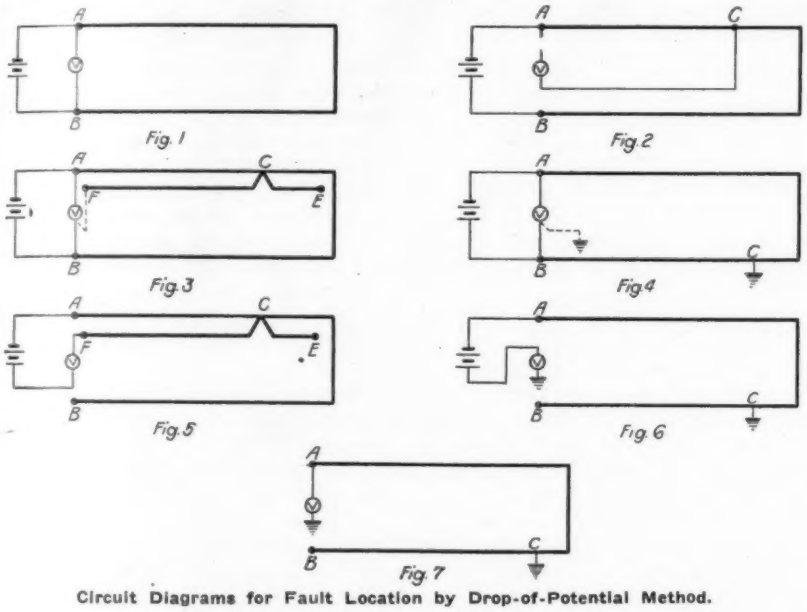
$$D/d=L/X \qquad (2)$$

from which

$$X=dL/D \qquad (3)$$

Therefore, if the total length is known, the length of the part may be calculated from equation (3).

Now, if the conductor is crossed with another at any point, the latter may be used, in effect, as an extension of the voltmeter lead, to measure the drop between the end of the conductor and the cross. For example, let the conductor ACB, Fig. 3, be crossed with the conductor FE at the point C. Then, if current from any convenient source is passed through the circuit ACB, the drop D over the entire circuit may be read by connecting the voltmeter V to the terminals AB, as shown by the full line, and the drop d from A to C, by connecting the instrument between A and F. Therefore, if L, the length of the circuit ACB, is known, the distance from A to C may be calculated from formula (3).



Circuit Diagrams for Fault Location by Drop-of-Potential Method.

Similarly, if the circuit had been grounded, Fig. 4, at any point C, the drop D over the total circuit could be measured as before and the drop from A to the fault could be determined by connecting the voltmeter between A and ground, as shown by the dotted line. The distance from A to the fault could then be calculated from formula (3) as in the case of a cross.

Application of the Method.—It is is to be noted that since the drop in both cases is proportional to the current flow as well as to the resistance of the conductor, the results will be inaccurate if the current flow is not the same when drop d is taken as when drop D is measured. A constant source of supply is therefore essential. This feature is of particular importance when primary batteries are used as the source of current because, as will be pointed out below, fairly large currents are sometimes necessary and when currents of more than a few amperes are drawn from ordinary cells the potential, and consequently the current flow, decreases quite rapidly. To meet this condition the battery leads should be connected to the circuit under test only long enough to read the voltmeter in each case, disconnecting the battery while the change in voltmeter connections is being made. This can be conveniently done by means of a small switch.

Where the circuit is of sufficient resistance to prevent excessive current flow, it may be connected directly to ordinary lighting mains, but in most cases where such a source of supply is to be employed it will be necessary to insert a suitable resistance between the mains and the circuit under test to keep the current within reasonable limits. If a resistance is used, all voltmeter connections should be made so that the resistance is not included in the portion of the circuit over which the drop is taken; in other words, the inserted resistance must not be embraced by the voltmeter leads.

It is to be noted that for a given error in reading the voltmeter, the error in the result will be larger the smaller the deflection. It is important, therefore, if an accurate location is to be made, that the deflections d and D be reasonably large proportions of the full scale of the instrument. If the circuit is of considerable resistance, satisfactory deflections can usually be secured with a small current and an ordinary 150-volt instrument, but if the resistance of the circuit is small, as in the case of a transmission line, a low-resistance voltmeter and a current flow of several amperes will be necessary to obtain deflections large enough to avoid serious inaccuracy in the location. The current flow should not, of course, be sufficiently great to heat the conductor, as its resistance would be changed thereby.

With any source of supply it is well to repeat the readings d and D several times, rejecting any which are not in practical agreement with the others for the same voltmeter connections. This will tend to eliminate error in reading the instrument and indicate whether there is any variation in the current flow. Where primary batteries or small storage batteries are used, the readings should be made as quickly as possible and the battery circuit opened promptly in order to avoid draining the battery

and consequent diminution of the current flow as pointed out above.

Even low-range voltmeters are of considerable resistance, so that extending the voltmeter terminal to the fault by means of the conductor with which the circuit is crossed, in case of a fault of that nature, or through the earth, in case the conductor under test is grounded, does not introduce appreciable error on account of the extension of the voltmeter lead.

If, however, the fault itself is of a resistance amounting to more than a negligible percentage of the voltmeter resistance, reading d will be in error by approximately the same percentage, unless a correction is made. The presence of excessive resistance at the fault can be ascertained by connecting the voltmeter as shown in Fig. 5, in the case of a short or cross, or as in Fig. 6, in the case of a ground. In either case the voltmeter reading will be practically equal to the voltage of the supply, if the resistance of the fault is negligible. If any appreciable difference is noted, an approximate correction can be made by increasing the reading d of the test by the percentage which the check reading is of the supply voltage. For example, if the voltage of the supply is 110 and the deflection when the voltmeter is connected as in Fig. 5 or Fig. 6 is 104.5, then the difference, considering 110 volts as 100 per cent, is 5 per cent. Therefore the deflection d given by the test should be increased by 5 per cent in calculating the location of the fault.

When the fault is a ground, it is important that the earth connection at the testing point be of low resistance, since undue resistance at that point would be as serious as a high resistance at the fault. A low-resistance ground can ordinarily be secured by connecting to gas or water pipes. In the absence of such means or a good existing ground, an iron rod driven four or five feet in permanently moist ground will usually be satisfactory.

The presence of earth potential between the ground at the fault and that at the testing point will also cause inaccurate results in measurements of that kind, unless proper corrections are made. The existence of such potential may be ascertained by connecting the voltmeter as shown in Fig. 7. If earth potentials are present, a deflection will be noted on the instrument and allowance can be made therefor by adding the deflection to the test deflection d, in case the earth potential is in the opposite direction to that of the test current, or by substracting the earth potential if they are in the same direction. It is also to be noted that when testing for the location of a ground, the current supply should not be grounded, as otherwise the current will not flow through all parts of the circuit under test in equal amounts, which is, of course, essential to the accuracy of the test.

In the foregoing, it has been assumed that the faulty conductor can be looped back to the testing point by a good conductor of the same gauge and material. This cannot always be done in practice, but if any conductor can be secured which can be connected to the faulty conductor at the distant end or at any point beyond the fault, and which is also available at the testing point, a location can usually be made, if the lengths of the faulty conductor and the return conductor, from the testing point to the point at which they are connected together, are known. It is not necessary that the lengths be the same, but it is essential that their resistances be known, and that each of the conductors be of uniform resistance throughout the length used in the test. The gauge of each conductor will usually be known, or if not, can readily be ascertained and the resistance calculated from standard wire tables.

The modification of the method which must be made, if the faulty conductor and the return are not of the same gauge and material, consists essentially in reducing D, the drop over the whole circuit, to an amount S representing the drop over the faulty conductor alone. If the resistance of the faulty conductor be represented by R_1 and that of the return conductor by R_2 then

$$S=R_1D/(R_1+R_2) \qquad (4)$$

This amounts to saying that the drop S over the faulty conductor alone is that proportion of the total drop D, which the resistance of the faulty conductor is of the total resistance. It is to be noted, however, that the drop S cannot be used in formula (3) since L in that formula represents the total length of both conductors. It is necessary therefore to change L to P, the length of the faulty conductor alone. The formula then becomes:

$$X=dP/S \qquad (5)$$

Examples.—The following examples will show the application of the drop-of-potential method.

(*a*) Two wires of a three-phase transmission line 12.6 miles long are crossed at some point between the generating station A and the distant end of the line B. For convenience let the wires be numbered *1*, *2* and *3*, and suppose the cross to be between wires *1* and *2*. Suppose further, that the test for the location of the cross is to be made at A and that a 220-volt direct-current supply is available. Transformers or other apparatus should, of course, be disconnected from the line at both A and B in order to leave the wires clear for test. Ordinarily this will merely involve opening switches or main-line fuses.

The question of whether or not the resistance of the cross is negligible should be determined first, by connecting one terminal of a voltmeter which will read 220 volts, to one side of the 220-volt supply, and the other terminal to wire *1*. Wire *2* should then be connected to the other side of the 220-volt supply and the deflection noted. The pressure at the terminals of the 220-volt supply should also be checked and the two readings compared. Assume that the voltmeter deflection is substantially the same in both cases, thus indicating that the cross itself is of practically no resistance.

Now let either of the crossed wires, say wire *2*, be connected at B to wire *3*. This connection should be firmly made so as to avoid introducing foreign resistance at that point and should be of sufficient conductivity to carry the testing current without heating. Arrangements should be made at A to connect the 220-volt supply to the same wires, i. e., *2* and *3*, through a resistance great enough to avoid excessive current flow. The voltmeter test connections at A may be made either directly to the line wires where they enter the station or to the line terminals of main-line switches or fuses, but in any event must be made on the line side of the resistance.

Connect the voltmeter first between wires *2* and *3*, close the circuit to the 220-volt supply and note the deflection. This deflection will be D since it includes the drop over the entire circuit. Assume it to be 10.75 volts.

Connect the voltmeter between wires *1* and *2* and note the deflection d. Suppose this deflection to be 4.20 volts. Since the line is 12.6 miles long, the circuit is double that or 25.2 miles.

These values may then be substituted in formula (3), thus

$$X=4.20\times25.2/10.75=9.85.$$

Therefore the fault is 9.85 miles from the generating station.

If conditions had permitted, a convenient alternative to the use of a resistance to limit the current flow in this case would have consisted in reducing the field excitation of the generator supplying the testing current, until a potential was obtained which could be applied directly to the circuit without causing excessive current flow.

(*b*) Assume that when the voltmeter was connected in series with the crossed wires to determine whether or not the resistance of the cross was negligible, the deflection had been 212.4 volts and that when the 220-volt supply was checked, it was found to be 220.8 volts. These readings differ by 8.4 volts, indicating that there is resistance at the cross itself which should be taken into account to avoid inaccuracy.

Let 220.8=100 per cent.

Then 8.4=3.8 per cent.

It will be necessary therefore to increase deflection d by 3.8 per cent.

d=4.20 volts,

3.8 per cent of 4.20=0.16 volt.

Then $d'=d+0.16=4.36$ volts.

Inserting this value in formula (3) gives

$$X=4.36\times25.2/10.75=10.2.$$

Therefore under these conditions the fault would be 10.2 miles from the generating station.

(*c*) Suppose that wire *1* in example (*a*) had been grounded. In that case the connection at *B* would have been made between wire *1* and either wire *2* or *3*, say wire *2*, and a test would not only have to be made to determine whether there was any appreciable resistance at the fault but also to find if there was any difference of potential between the fault and *A*. The question of potential should be settled first, since if potential were present, it would give false indications in the test to determine the presence or absence of resistance at the fault, as well as in the location itself, unless proper allowance were made in each case.

The presence of earth current could easily be detected by connecting a voltmeter between wire *1* and the station ground. If a rapidly fluctuating potential were found, a representative value should be calculated by taking a series of readings, say every five seconds for a minute and determining the average. If the potential fluctuated slowly, some mean recurring value should be selected and the connections arranged so that the voltmeter could be left in circuit between wire *1* and ground until the chosen potential recurred and then shifted quickly to the proper connection for the desired reading. If the potential were found to be constant, the procedure would, of course, be much simplified, but in practice a constant difference of potential between two grounds is seldom encountered. Suppose, in the case in question, that a difference of potential is found which varies slowly between a minimum of 0.65 volt and a maximum of 2.85 volts and that a value of 2.0 volts is of frequent occurrence, the ground at the fault being at all times negative to the station ground. Since the fault has been assumed to be negative to the station ground, the positive terminal of the voltmeter would be connected to ground and the negative terminal to wire *1* to read the earth potential. Therefore, if the negative side of the 220-volt supply were grounded and the positive voltmeter terminal shifted quickly from ground to the positive side when an earth potential of 2.0 volts was noted, the deflection would be equal to the actual voltage of the supply plus 2.0 volts, if no appreciable resistance were present at the fault. If resistance were present at the fault, the deflection would be less than that value by an amount depending upon the amount of resistance. Suppose, in this case, that the actual voltage of the supply was, as before, 220.8 and that the deflection obtained in the manner just described, was 208.4. Since this value was obtained with an earth potential of 2.0 volts assisting the 220-volt supply, the deflection is 2.0 higher than if no earth potential had been present. Consequently, the true value by which to modifv *d* would be 206.4.

The drop *D* over the entire circuit should then be taken by connecting the voltmeter between wires *1* and *2* and passing the proper testing current through the same wires. In taking the drop *d* it will be necessary to observe the same precaution as in determining the correction to be made for the presence of resistance at the fault, namely, to select a particular value of the earth potential and take readings only at times when that value is observed. Since 2.0 volts was chosen in the former test, that value might be selected for the present test, though any other recurring value would do as well. Since the positive voltmeter terminal is connected to ground to observe the earth potential, a change in the voltmeter connections can be avoided by connecting the positive side of the 220-volt supply to wire *2*.

With the negative side not connected to wire *1*, no testing current flows through the circuit and the voltmeter reads only the earth potential, but when connection is made the voltmeter reads the drop *d* from the fault to *A* plus the earth potential at that moment. Therefore, by making connection between the negative side and wire *1* only when the earth potential is 2.0 volts, that value can be subtracted from the total deflection to find the drop which would exist if no earth potential were present.

Assume the deflection *D* to be 15.4 volts and the deflection *d* to be 8.95 volts. As indicated, the latter deflection is too large by 2.0 volts so that the true deflection *d* would be 6.95 volts, which could be used directly in formula (3) were it not for the presence of resistance at the fault, as shown by the preliminary test. The actual voltage of the supply in the preliminary test was 220.8 and the corrected deflection was 206.4 volts, giving a difference of 14.4 volts. As before, let

$$220.8=100 \text{ per cent,}$$

then $14.4=6.52$ per cent.

It will, therefore, be necessary to increase deflection *d* by that percentage, giving a corrected deflection *d'* of 7.40 volts. The values may now be substituted in formula (3) thus

$$X=7.40\times25.2/15.4=12.1.$$

Accordingly, the ground on wire *1* is 12.1 miles from the generating station.

(*d*) A No. 6 B. & S. single-phase signaling circuit carried on a 33,000-volt transmission line is crossed out at some point between the generating station *A* and a substation *B*, 16.4 miles distant. A "good" wire for the location of the fault cannot be taken from the transmission line on account of interference with service but a No. 12 N. B. S. gauge telephone circuit carried on the same pole line is available. In order that the wires may be clear for test the terminal apparatus at *A* and *B* should be removed from the signaling circuit and from the telephone circuit and one of the wires of the signaling circuit connected at the substation to one of the wires of the telephone circuit. The remaining wire of the signaling circuit will therefore be used as an extension of the voltmeter lead to the cross. For convenience, call this wire *1*, the other wire of the signaling circuit wire *2*, and the telephone wire which will be used to loop the circuit back to the testing point *A* wire *3*. The connection at the substation will therefore be made between wires *2* and *3*.

Assume that a preliminary test shows that the resistance of the fault is negligible and that the location test gives a drop *D* over the entire circuit of 24.6 volts and a drop *d* from *A* to the fault of 3.45 volts. Since the return wire *3* is not of the same gauge as that of the faulty wire, it will be necessary to determine what portion of the total drop *D* is given by the drop over the faulty conductor alone. The resistance of the faulty conductor is that of 16.4 miles of No. 6 B. & S. gauge copper, which at the temperature at the time of test, 60 degrees Fahrenheit, is 33.6 ohms ($=R_1$). The resistance of the telephone wire taken from resistance tables for the same temperature is 81.5 ohms ($=R_2$). The drop over the faulty conductor alone is by formula (4)

$$S=33.6\times24.6/(33.6+81.5)=7.18 \text{ volts.}$$

Substituting this value and the length of the faulty conductor in formula (5) gives

$$X=3.45\times16.4/7.18=7.88 \text{ miles.}$$

Accordingly the fault is 7.88 miles, or for practical purposes 7.9 miles from the generating station.

Electric Utility Companies in Japan.

According to the monthly report just published by the Electricity Bureau in the Communications Department at Tokyo, Japan, electric enterprises in that country at the end of May numbered 615, the combined capital amounting to $303,410,786 United States currency. In comparison with the end of 1914 there is an increase of 14 in the number of enterprises and $541,475 in their combined capital.

Power-supply companies make up the largest number of these, being 524 in all with a combined capital of $154,793,112, while electric street-railway companies number only 44, though their combined capital is $25,520,010. Others number 47 with a combined capital of $123,147,463. The total power-generating capacity of all of these electric companies is estimated at 727,783 kilowatts, being an increase of 7,551 kilowatts over that at the end of last year. During May four new electric lighting companies were organized.

Regulation of Public Utilities.

On the evening of November 22 a dinner meeting was held at the Hotel Sherman, Chicago, by the Chicago Section of the American Institute of Electrical Engineers, and the Electrical Section of the Western Society of Engineers. In opening the meeting directly after the dinner, Chairman W. J. Norton, of the Chicago Section, and the speaker of the day, Leonard A. Busby, spoke feelingly of the late H. M. Wheeler, who was chairman of the Electrical Section of the Western Society of Engineers.

The main feature on the evening's program was the presentation of a paper by Leonard A. Busby, president of the Chicago Surface Lines, the title of the paper being "Regulation of Public Utilities." Mr. Busby opened the paper by referring to the need of free discussion and educational publicity, in order to familiarize ourselves with regulation problems. He then took up the question of utility regulation, dealing particularly with the electric railway systems of large cities. He spoke of the great importance of street-railway service to everyone in the community, and showed how the traction question is not so much one of rates, since the five-cent fare is still practically universal, but one almost entirely of service. The rapid growth of large cities makes the service problems very aggravating, particularly during the rush hours. In Chicago, for instance, about 250,000 people are carried out of its central business district during the evening hours. The street-railway system of Chicago employs 9,000 motormen and conductors, and handles about 3,000,000 passengers a day, which easily accounts for more or less frequent complaints. No other utility comes in such close and frequent contact with its customers.

Mr. Busby then took up what he called the multiple-unit regulation of utilities and particularly of the Chicago traction lines. First, there is the City Council and its very active Local Transportation Committee; the individual aldermen and various local improvement associations all wish to have an emphatic voice in the control of the service. By the Chicago ordinances there was created the Board of Supervising Engineers, which during the last eight years has very ably supervised the expenditure of $90,000,000 additions to the capital account. Finally there is the recently created Illinois Public Utilities Commission. These various regulatory bodies cause considerable conflict in regulation and a recent order of the State Commission has brought the matter to a head on account of being in direct conflict of the ordinance requirements.

The American public is insisting more and more on higher standards of service, although the rate of fare has not been materially changed in the last fifty or so years. It is now possible to ride in Chicago 30.5 miles for five cents, as compared with a five-cent ride of 1.1 miles in 1859. The type of car, its heating, ventilation and arrangement for comfort of passengers and the speed of service have all been greatly increased without increase in the compensation. Mr. Busby said the electric railways of the country represent an investment of about $5,000,000,000. He cited figures from the censuses of 1902, 1907 and 1912 showing that the amount of new capital going into electric railway systems is diminishing, which is due to the uncertainty of the return and the increasing burdens of regulation. At the present time 26 states have commissions whose power extends over electric railways. Although the functions of these commissions are variously defined, on the whole their object is to regulate chiefly the rates and service. The latter regulation should provide three predominant features: (1) Continuity of service. (2) Extension of service. (3) Improvement of the service. The two latter requirements necessitate the investment of more and more new capital, which requires that the utility have unimpaired credit.

Mr. Busby then took up the basis of sound regulation and enumerated the five chief elements involved therein. These are as follows: (1) Regulation presumes just, reasonable and adequate service requirements based upon just and reasonable compensation. (2) Regulation must not be so directed as to destroy the incentive to economy and efficiency. (3) A reasonable standard of service having been prescribed, the method and detail of providing that service should be left to the utility. (4) Unnecessary interference with operation is bad, and tends to increase the cost of service and to increase the cost to the public of maintaining the regulation. (5) The right to regulate these utilities is neither municipal nor state ownership. These points were elaborated in considerable detail by Mr. Busby. In conclusion he called attention to the change of attitude of the state government to utilities. Whereas in the early days the legislature was urged to encourage internal improvements, nowadays the excessive zeal of utility commissions and of various regulatory measures, if unchecked, would put practically every public utility concern out of business. Fortunately the courts are still fair-minded.

The paper was discussed briefly by Bion J. Arnold, who referred to the fact that many utility companies in recent years, especially street railways, have accepted settlement ordinances, the Chicago traction ordinances of 1907 being the first and practically models of this type. Speaking of the rates of return that are guaranteed to these utilities, he showed that the Chicago traction companies receive at least five per cent on their investment, and the surplus above this is divided between the city and companies. In Cleveland the street-railway company is definitely limited to a return of six per cent. In Kansas City the recent ordinance fixes the return at six per cent and utilizes any surplus over this for retiring intangible valuations. Mr. Arnold said he believed that the best interests of all would be concerned by going one step further; namely, after guaranteeing a fixed return on an agreed valuation and retiring the intangibles, further surplus should be used for improving the service.

Radio Station for Society Islands Near Completion.

The radio station now being built by the French Government on Tahiti Island, Society Islands, will be ready to receive and transmit commercial messages before the close of 1915, the United States Bureau of Navigation announces. The temporary station now in course of erection will be followed by a much more powerful plant. The plans of the temporary station contemplate a 10-kilowatt installation of the type used by the French Government, with a wave length of 600 meters. The two towers will be 100 meters in height. The station will be expected to reach Awanui, New Zealand; Suva, Fiji, and the Samoan Islands.

Immediately upon the completion of the temporary station work will begin on the permanent station. This permanent 300-kilowatt station will be operated by a 500-horsepower gasoline engine, and will use a wave length of 2,500 meters. There will be eight towers, each 100 meters high, erected in parallel rows of four towers. The space between the towers will be 250 meters, and 200 meters between parallels. There will be two anennas, one of 600 meters wave length, the other of 2,500 meters.

With the permanent station it is expected that communication will be established with stations in Cochin-China; South America; Honolulu, Hawaii; San Francisco, Cal.; Sydney, Australia; and even in Martinique and Guadeloupe, West Indies. All material used in the construction of these stations is supplied by the French Government and is shipped from France.

Benjamin Banquet.

Fifty-two executives and salesmen of the Benjamin Electric Manufacturing Company attended a banquet given by the company's manufacturing department to the members of the sales and advertising departments of the Central Division, at the Hotel La Salle, Chicago, Monday evening, November 22.

E. A. Drake, factory manager, acted as toastmaster. In calling the meeting to order he referred to the fact that in order to co-ordinate the various departments of a growing organization after the manner required by scientific management, it became increasingly necessary that each should know something of the problems of the other. Harmony and co-operation were essential to successful business building. These could be promoted by a sympathetic study of the difficulties as well as successes in various lines of endeavor. With this thought as the keynote of the meeting the two principal speakers of the evening were introduced.

The first was R. B. Benjamin, president of the company. He held his audience in rapt attention with a preliminary historical sketch of the company's development. After enumerating a number of handicaps which beset the path of the inventor he exhibited samples and models showing various steps in the evolution of an attractive new line of wiring devices which are now under consideration. He was followed by W. D. Steele, vice-president and general manager of the company, who discussed at some length the various factors which enter into the cost of an article after the items of material and factory labor had been disposed of. In a concise and clean-cut manner he followed the various operations incident to the manufacture and sale of goods, showing in detail their relative importance, and pointing out how in the aggregate, relatively insignificant items of expense might appreciably increase the cost of an article to the ultimate consumer.

Both addresses by the officers of the company were well received. They were followed by five minute rapid-fire talks on the following subjects:

"Quality of Material and Service in Salesmanship."

"The Place of Advertising in Business."

"Engineering - Department Problems."

"The Figuring of Costs."

"The Advantage of Bonus Rates in Production."

"The Metal Market."

"The New Field for the Factory Signal Horn."

"The Packing and Labeling of Goods."

"The Handling of Orders."

"Educational and Welfare Work Among Employees."

Among those who contributed to the discussion were A. E. Lubeck and G. B. Weber, salesmen; Andrew N. Fox, advertising manager; H. Pollard, superintendent of manufacture; L. W. Kester, manager of Cost Department; O. F. Westphal, inspector; C. B. Harlow, engineer of Auto Device Division; H. A. Varnell, purchasing agent; J. Estes, foreman of Traffic Department; Paul Phillips, chief engineer; H. A. Frahm, foreman of Plating Department; J. M. Watson, foreman of Assembly Department; George Thyer, manufacturing order clerk; Fred Stranberg, order clerk; C. H. Harrington and C. Vroman, stockkeepers.

Results of Electric-Furnace Operation in an Alaska Mine.

The gold precipitate from the zinc-dust presses in the cyanide plant of the Alaska-Treadwell Gold Mining Company, at Treadwell, Alaska, is treated, in the refinery adjoining, by the Tavener, or lead-smelting method. About 3 or 4 tons of this precipitate is produced monthly, having a gold assay value of $40,000 to $60,000 per ton.

It was formerly the practice to treat the by-products from this process, consisting of 2 tons of slag, 300 pounds of matte, 500 pounds of refinery refuse, flue dust, etc., in a 24-inch water-jacketed blast furnace. This practice was discontinued in the summer of 1914 by reason of the difficulty of keeping the lead-well open when treating a high-grade lead product; of preventing the loss of gold in the flue dust; and of avoiding injury to the general health of the refinery operators; a plain single-phase electric furnace was substituted for the blast furnace.

The furnace was constructed from an old steel acid drum by cutting off the top and introducing a cable, made from strands of bare copper wire, through the bottom and spreading the strands out fan-shaped on the inside of the drum.

Powdered graphite, obtained by grinding up old crucibles, mixed with 10 per cent cement, was tamped wet into the bottom of the drum, around and completely covering the copper wires. The graphite was carried up to the bottom of the furnace, or lead-well, and acted as the lower electrode. The sides were built up of ordinary fire brick forming a melting chamber 14 inches in diameter by 20 inches high.

The upper electrodes, of graphite or carbon, are three inches in diameter and 40 inches long, arranged with joints enabling new electrodes to be connected without shutting down or wasting stubs. A screw feed was arranged for raising and lowering the upper electrode.

The cover for the furnace had three openings, one for feeding the charge, one for the escape of gases, and one in the center for the introduction of the electrode. It was later found more practical to enlarge this center opening to 6 inches in diameter, to allow of a central feeding of the charge around the electrode. A 4-inch pipe connected to a ventilating fan carries off the escaping gases. The furnace is operated on the lighting circuit through a 50-kilowatt transformer, at 60 cycles, 110 volts.

In starting, the furnace is operated as an arc furnace, until it has become thoroughly hot, when the charge, consisting of slag, brick dust, etc., is added, the electrodes being raised as the load in amperes increases, until the entire chamber is filled with the charge and the upper electrode extends into the melt almost a foot. As the charge continues to melt the electrode is moved down or up, keeping the amperage reading as nearly constant as possible. The raising or lowering of the upper electrode decreases or increases the power consumption and thereby affects the amount of heat generated.

At this stage the furnace is no longer operating as a simple arc furnace, but has automatically transformed itself into a resistance type of furnace, the semi-fluid or molten charge acting as the resistant, the current passing from one electrode through the center of the charge to the other.

After the charge is in quiet fusion, which takes on an average 2 hours and 10 minutes, the power is turned off and the charge allowed to settle.

In operation, the molten lead and slag are tapped, as in the blast furnace. If the lead freezes it is melted by diverting current from the upper electrode and letting it pass through the lead, the tapping rod playing as an arc on the side of the furnace or into the lead tap. The operators use colored or amber glasses to protect their eyes from the glare of the electric arc.

Total running time, 128 hours 40 minutes.
Average weight of charge added, 160.5.
Average fusion time of charge, 2 hours 25 minutes.
Total number of charges, 53.
Graphite electrodes used, one per 24 hours.
Total energy for 128 hours 40 minutes, kilowatt-hours, 4,440.
Energy used per hour, 34.50.
Energy used per pound of material fed, kilowatt-hours, 0.52.
Energy used per ton of material fed, kilowatt-hours, 1,044.
Acheson graphite used per hour, feet, 0.15.
Material melted per hour, pounds, 67.7.
Material melted for 24 hours, pounds, 1,625.

Both graphite and carbon electrodes are used, the former costing $2.95 each, and the latter $1.20. Power cost is less than one cent per kilowatt-hour.

The labor required for the operation of the furnace, including the work of charging and tapping, is one-half one man's time.

BOOK REVIEWS.

"Dielectric Phenomena in High-Voltage Engineering." By F. W. Peek, Jr. New York: McGraw-Hill Book Company, Incorporated. Cloth, 264 pages (6x9 inches), 190 illustrations. Supplied by the Electrical Review Publishing Company, Inc. for $3.00.

"Though old the truth and oft exprest,
'Tis his at last who says it best."

This is the poet's way of stating the principle that controls in the preparation of most textbooks. This, however, is not wholly true with reference to books on technical subjects, especially those that give the results of investigations and research. The book before me belongs to this latter class. Although much work has been done in studying the properties of dielectrics, perhaps most of the investigations have been made with comparatively low voltages. The facilities of the General Electric Research Laboratories permit the investigations of the effects of high voltages which very few, if any, other institutions can equal.

After a general mathematical analysis of the dielectric field and dielectric circuit, Mr. Peek gives the results of his extensive research in high-voltage problems. He not only gives the results of his investigation, but analyzes these results and where possible derives general laws. The subject is treated under the following heads: Visual Corona, Spark-over, Corona Losses, Corona and Spark-over in Oil and Liquid Insulations; Solid Insulations, Electron Theory; Practical Corona Calculations for Transmission Lines; and Practical Considerations in the Design of Apparatus where Solid, Liquid, and Gaseous Insulations Enter in Combinations. A practical bearing is given the treatment of each subject and many photographs of visual corona and oscillograms of the corona current are given. One of the interesting and important features of the book is the extensive consideration given to the manner of making engineering investigations and of reducing the data, the measurement of high voltages, the effects of impulse and high-frequency voltages, and the outline of modern theory. The book will undoubtedly prove useful to engineers and also to students of high-voltage phenomena.

C. M. Jansky.

"Telephone Appraisal Practice." By J. C. Slippy. Pittsburgh: J. C. Slippy. Cloth, 98 pages (6 x 8¾ inches). Supplied by Electrical Review Publishing Company, Inc., for $4.00.

This volume applies the principles of public-utility appraisals to telephone plants exclusively, and is unique in this respect. It comprises six chapters. The first explains the objects and scope of the work and methods used. The second deals with inventory and gives a number of useful forms. The third considers costs and gives a large number of average unit costs. This is probably the most valuable portion of the book. The fourth chapter deals with depreciation and also gives data taken from actual experience. In the fifth chapter a list of state utility commissions, with their powers, is given, and the requirements of different commissions discussed. The last chapter consists of a single page of bibliographical references. The book should be of service both to managers of telephone companies and to engineers dealing with this class of work.

"Elementary Electricity and Magnetism." By W. S. Franklin and Barry MacNutt. New York: The Macmillan Company. Cloth, 174 pages (4¾x7½ inches), illustrated. Supplied by the Electrical Review Publishing Company, Inc., for $1.25.

"Advanced Theory of Electricity and Magnetism." By William S. Franklin and Barry MacNutt. New York: The Macmillan Company. Cloth, 300 pages (5½x8½ inches), illustrated. Supplied by the Electrical Review Publishing Company, Inc., for $2.00.

The authors of these two volumes have, by their previous publications, led folks to expect something original in their treatment of courses of study. The intention is here expressed to "keep the student's mind jammed up tight against physical things." This seems to the reviewer to have been better accomplished in the elementary text than in the advanced course, which is largely of a mathematical nature. The general treatment in both volumes is good, and the idea of connecting the study of physics as far as possible with practical things is excellent.

The elementary book has but five chapters, and leads from the more familiar things to the more complex. The sub-title informs us that it is a textbook for colleges and technical schools. This is borne out by the use of algebraic expressions and chemical formulas, but the simplicity and brevity of the subject matter seems more suited to high-school or even grammer-school classes. There are some things taught which will have to be unlearned later, such as the statement that Ohm's law is not true for circuits containing motors or storage batteries. Indeed the derivation of this law is such as to completely mask its significance. The text is amplified by problems, a desirable feature.

The advanced course contains ten chapters dealing with magnetism, electromagnetism, electrostatics, electric waves and electrons. The last subject is treated in a descriptive rather than mathematical way, but the earlier chapters involve the use of calculus and are mainly mathematical. The scope is "advanced" in comparison with the elementary volume, and is well adapted for a college course. Problems illustrate the work of each chapter.

"Arithmetic of Alternating Currents." By Ellis H. Crapper. London: Whittaker & Company. Cloth, 208 pages (4¼ x 7¼ inches), 45 line diagrams. Supplied by Electrical Review Publishing Company, Inc., for $0.75.

Each chapter of this excellent little book contains an explanation of the principle involved and a solution of one or more problems, thus illustrating the method to be employed. A set of exercises is then given, answers to which may be found in the back of the book. In this way the student is enabled to check his work. There are ten chapters in all, dealing with Periodic Quantities, Generation, Inductance, Capacity, Parallel Circuits, Polyphase Power, Transformers, Motors, etc.

"Calcul des Lignes Aériennes au Point de Vue Mécanique par des Abaques." By André Blondel. Paris: La Lumière Electrique. Paper, 63 pages (8½ x 10¾ inches), illustrated. Supplied by Electrical Review Publishing Company, Inc., for $1.25.

The author has from time to time worked out curves for the computation of transmission lines. These are reproduced here with explanations and derivations of the formulas used, and comparisons are made. The last curve applies to aluminum. The effects of temperature and of stretching are considered. Applications of the method to actual cases are taken up, and various conditions considered. The third chapter deals with the supports. Appendices give the French regulations and a bibliography.

"The Year-Book of Wireless Telegraphy and Telephony, 1915." New York: The Marconi Publishing Corporation. Cloth, 800 pages (5¼ x 8¼ inches) with illustrations and map. Supplied by the Electrical Review Publishing Company, Inc. for $1.00.

This is the third issue of the Year-book, and in size it is almost the same as the previous edition. Among other things it includes a record of the year's developments; laws and regulations; a list of wireless stations with call letters (this occupies over 250 pages); useful formulas, data and tables; patents granted during the year; lists of operating companies and wireless societies; codes; bibliography; and a number of special articles dealing with radio subjects. A wireless map of the world, 32 by 20 inches in size, is bound in the back of the book. It shows the location of wireless stations and also the principal steamship routes. This book will be indispensable to those having frequent need for information along the lines noted. There is a great deal of incidental matter of interest, such as portraits and biographies of well known men, dictionary of terms, and calendars. There is a full index. The paper used is thinner than that in the previous volume, so that a less bulky book is the result.

New Electrical and Mechanical Appliances

Electric Heater to Prevent Gasoline Automobiles from Freezing in Cold Garages.

The approach of cold weather is again bringing troubles to the owners of gasoline automobiles. Aside from the difficulty of starting a chilled engine there is the great danger of having the radiator freeze up, which means heavy expense as well as trouble. To overcome this latter difficulty it has come to be a practice by many to use so-called anti-freezing mixtures, which are not always reliable, or to drain the radiator on leaving the car in an unheated garage, which requires refilling, generally with warm water, before starting up; all this is very inconvenient, however. To put in any stove, gas or steam radiator to heat the garage is expensive. Moreover, the engine and machinery contained within the hood of the car is all that really needs to be kept warm.

Electric Heater for Gasoline Cars.

This problem has been very happily solved by means of a very simple and compact electric heater recently placed on the market by the Hughes Electric Heating Company, 211 West Schiller Street, Chicago, Ill. As shown in the accompanying cut, this heater is shaped like and is about the size of a common dry cell. It contains a durable heating element that takes but 100 watts on any 110-volt lighting circuit, to which it is attached by means of a rugged 10-foot cord and plug. The shell and end caps thoroughly protect the element and are neatly finished. The shell is perforated to allow circulation of the heated air from within. The outfit weighs less than one pound.

To use this heater, the plug is merely inserted into any lighting outlet in the garage (and every garage should have at least one such outlet), place the heater within the hood of the car, and then turn on the current. It keeps the vitals of the car at a uniform, safe temperature which permits starting up without delay and exertion. The cost of the heating current is but one cent or less per hour where the maximum rate is 10 cents per kilowatt-hour. This simple device should prove a great boon to the motorist who has not yet been converted to the merits of the electric vehicle.

New Swiveling Attachment Plug.

In the last few years there has been an extraordinary increase in the use of electrical appliances adapted for

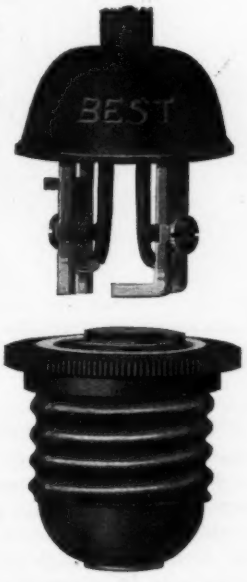


Fig. 1.—Plug Separated to Show Post Construction.

ready connection to lighting circuits by means of flexible cord and attachment plugs. Every possible means for reducing the cost of production of such appliances with their connecting cords and plugs should be encouraged, as it results in a reduction in price and consequent increased sale.

To aid this tendency the Best Electric Company, Fifty-first and Harrison Streets, Pittsburgh, Pa., has placed on the market a new attachment plug which it is said can be wired in less than half the time that is required to wire an ordinary plug. The secret of this advantage lies in the interior construction of the plug which, as shown opened in Fig. 1, can be seen to have very convenient binding posts. The wire is merely inserted through the cap and the ends bent over the binding posts and fastened by the terminal screws. There is no need of making a knot in the cord, since the posts are so constructed as to act as a very effective strain-relief device, which also serves to prevent the wires slipping. The wires are cut to even lengths, thus reducing waste and facilitating the wiring job.

The screw shell of the plug is of the swiveling type, which permits easy connection of the plug without twisting the cord. The body of the plug and its cap are made of an asbestos composition which is heatproof, does

Fig. 2.—"X-Ray" View to Show Plug Interior.

not burn, melt or warp and is not affected by oil or water.

Protection from Submarines.

An Italian electrical engineer, Emile Guarini, has announced the invention of apparatus which will enable a vessel to deflect the course of a torpedo which has been aimed at it, and also to make the torpedo explode before coming in contact with the vessel. The means used is said to be electrical, but the nature of the apparatus has not been announced. It is said that even though the use of this device may be known to those firing a torpedo, it will be impossible to prevent its application.

Light-Weight Street-Railway Motor.

The encroachment of the "jitney" in the street-railway field has led to the study of the broad problem of transportation, and the conclusion reached is that a light-weight car weighing from 8,000 to 12,000 pounds completely equipped, without load, with possibly one-man operation, would be a requirement at an early date.

A car of this weight would have a seating capacity of 24 to 30 passengers, depending upon the arrangement and design, and would meet the requirements of most operating companies during the light-load periods, and in most cities of 100,000 population or less, will undoubtedly meet all requirements.

The economies of a light-weight car are numerous, since it involves power consumption per average passenger hauled, track maintenance, brake-shoe and wheel wear, and above all, platform expense, as one-man operation is possible where local conditions permit. The larger number of cars which can be purchased for the same amount of money permits more frequent service for a given investment, and in turn faster schedules are possible, due to less stops made with frequent headway. The public, as a rule, appreciates rapid and frequent service, which if properly advertised would unquestionably be more attractive than the jitney.

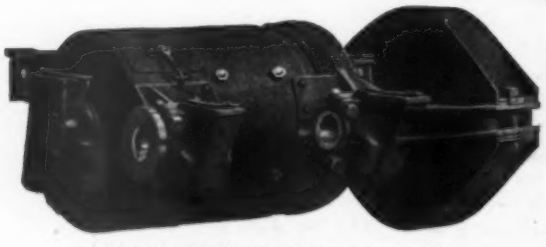
The Westinghouse Electric & Manufacturing Company, realizing the necessity for a motor to fill the requirements of light-weight car operation, made a thorough investigation of the requirements which would have to be met under the varying conditions, and developed an entirely new motor of light-weight yet rugged construction to properly perform such service. The result is the new No. 505 railway motor, popularly designated as the "Wee" (Westinghouse Electric Efficiency) motor.

This motor has a rating of 17.5 horsepower at 600 volts, and weighs, complete with gears, gear case and axle bearings, 800 pounds. It is said to be the lightest weight motor for railway service ever placed on the market. The design includes all of those features which have proven successful in larger sized motors that have been on the market for some years, only such changes being made as are necessary to adapt it to the service requirements.

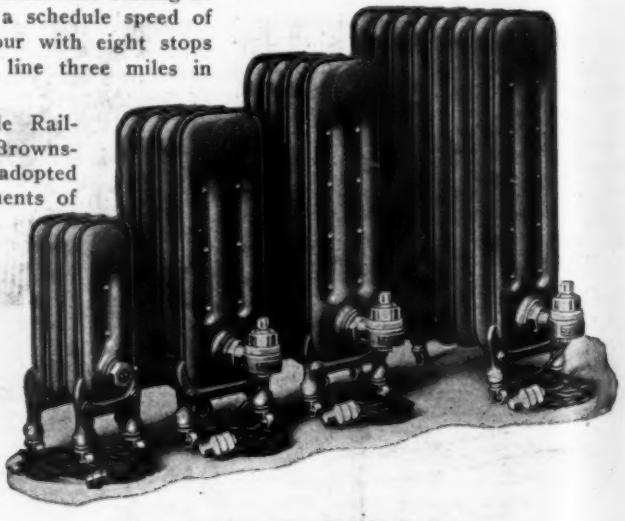
The Corpus Christi (Tex.) Street Railway Company was the pioneer in working out this problem, and ascertaining the availability of the Wee motor, purchased eight double equipments for immediate delivery. The company operates a city line three miles long, and the cars, weighing 14,000 pounds, are to make eight stops per mile, with a maximum speed of 30 miles per hour.

The Albuquerque Traction Company, Albuquerque, N. M., also purchased seven double equipments of this motor, for city service. The cars, weighing 11,800 pounds and seating 28 people, will have a schedule speed of nine miles per hour with eight stops per mile, over a line three miles in length.

The Rio Grande Railway Company, Brownsville, Tex., has adopted two single equipments of No. 505 motors. The existing road is operated by mules and one of the Wee motors will satisfactorily perform the service requirements.



"Wee" Light-Weight Street-Car Motor.



Several Sizes of Lee Electric Radiators.

Lee Electric Radiators.

The marked advantages of electric heating, due to its safety, convenience, absence of air contamination, and ability to apply it wherever needed, are bringing about its steadily increasing use, particularly in places where it is possible to secure comparatively low rates, whether they be primary, secondary or tertiary. Such rates, say five cents or less per kilowatt-hour, make the cost of operation moderate.

In the case of rooms where no heating equipment is provided, such as so-called sun parlors, ticket and cashiers' booths, etc., the installation of portable electric radiators proves not only very effective but quite economical, both in first and operating costs. In many cases rooms that are exposed to strong winter winds are found to be inadequately heated and the provision of additional heat is most conveniently and cheaply done by placing in such a room a portable electric radiator that may be readily connected to existing lighting or wall outlets.

To meet the growing demand for equipment of this character, the Lee Electric Radiator Company, 335 Wells Street, Chicago, Ill., has developed a line of portable radiators, comprising complete self-contained units rated at 200, 500, 750 and 1,000 watts. These appliances have been designed to provide steady and easily controlled heat by means of a portable radiator that may be readily placed where the heat is needed; they are also so built as to give a durable equipment that involves minimum maintenance costs.

The principle involved in the construction is that of an open resistance coil submerged in a circulating, non-corroding, non-freezing, insulating liquid; this is a commercial fluid that does not materially increase the cost of the appliance. The entire unit is hermetically sealed; therefore there is no evaporation of the liquid. The electric coil is contained in the bottom longitudinal passage of the radiator, and by use of the liquid as a circulating medium steadiness and uniformity of heat is produced on the entire heating surface of the radiator, which resembles a steam or hot-water radiator, but has no valves or vents. The fundamental principle of circulation is carried out to perfection; the radiator operates efficiently and quietly without the pounding and hissing of steam radiators. It also holds its heat well after the current is turned low or off.

These units are easily installed. They require no connection to any piping system. They may be quickly attached to any lighting socket or wall receptacle and can be easily regulated by means of a three-heat switch. The casters with which they are equipped

make them easily transportable from one location to another, the 500-watt size weighing approximately 40 pounds complete. The 500-watt or most popular size can be operated at full heat for only two cents per hour in localities where the cost of current is four cents per kilowatt-hour and proportionately for other rates. As soon as the radiator has reached full heat, the current can usually be reduced to an amount sufficient to maintain this heat, thus producing further economy.

Chase Changeable Signs.

There are many places where the ability to change an electric sign from time to time is very advantageous. For instance, theaters must announce their changes of bill frequently, department stores and other merchandising establishments very often have special sales and in many other cases the possibility of changing the sign gives renewed interest and value to it on account of the attention it continues to command.

In line with this idea the Chase Electric Company, 105 South Dearborn Street, Chicago, Ill., has developed a system designed primarily to permit the ready change of electric signs. However, it is well adapted also for miscellaneous purposes where it is desired to connect various appliances to convenient outlets quickly and interchangeably. The system consists of what are called wireless continuous sliding contact strips; these are molded of Bakelite insulating compound and include two phosphor-bronze continuous strips that form the terminals of the circuit. The arrangement is well shown in Fig. 1. The upper portion of this diagram is a front view of these strips and at the upper right corner is a simple end view thereof. A rear view of this set of strips is shown in the lower portion of the diagram, and in the lower right corner is shown a typical contact hook which answers the purpose of an attachment plug. This may be connected to the back of the letter in the case of changeable signs, or to an extension cord where portable appliances are to be connected to the continnous contact strips. The contact hook needs merely to be obliquely inserted from the upper front portion of the strip and in the case of a sign letter this thereby hangs it in place.

Fig. 1.—Continuous Contact Strip for Changeable Signs, Etc.

From this it is readily seen that to change a sign is a matter of but a few moments. The advantage of this arrangement in the case of signs is not only that it very decidedly facilitates the change of the sign, but it eliminates the need for having on hand a multiplicity of signs. All that is necessary is to keep on hand a few sets of the various letters of the alphabet, the number depending upon the relative frequency of use of the various letters and also upon the total number of letters to be displayed in the sign. A typical installation of one of these changeable signs is shown in Fig. 2, which is the main entrance to the La Salle Opera House on Madison Street, near La Salle Street, Chicago.

Fig. 2.—Changeable Sign in Front of Theater.

This entire system is built up of unit parts. For instance, the continuous contact strips are made in unit lengths of two and four feet. By joining two of these it is evident that a six-foot sign can be obtained; likewise, by further assembly a sign of any length is obtainable; a four-foot sign base made of two two-foot units is shown in Fig. 3. To get greater width in the sign it is likewise possible to add unit width sections to obtain any desired width or height of sign. The company sells durable letters of various forms equipped with the contact-hook device shown in the lower right corner of Fig. 1.

Wallace Lamp-Shade Patent Held Valid.

The United States District Court, Southern District of New York, has held after a hearing that United States patent No. 1,117,131 dated November 10, 1914, which is the patent covering the lamp shades upon the portable electric lamps of the Wallace Novelty Company, Incorporated, is a valid patent and that it has been infringed by the Leindorf Electric Light Company, of New York City, which has been selling a lamp with a shade of this description.

The court has granted a permanent injunction forbidding the Leindorf Electric Light Company or its agents from manufacturing, using or selling lamp shades of this character and has ordered that an accounting for profits and damages be made to the Wallace Novelty Company, Incorporated.

Fig. 3.—Four-Foot Strip Made Up of Two Units.

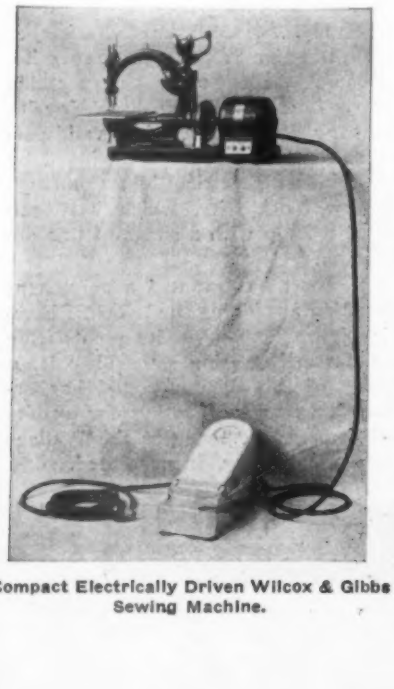
Electric Drive for Wilcox & Gibbs Sewing Machine.

A new type of motor for the Wilcox & Gibbs domestic sewing machines was shown in operation at the recent New York Electrical Show in the Westinghouse Electric & Manufacturing Company's booth. The motor is smaller than those previously used and is coupled directly to the machine shaft without use of belts, brakes or friction drive.

The speed of the motor and hence of the needle is under perfect control by the operator from a special foot pedal supplied with the motor. In this pedal there is a specially constructed resistance which has virtually an unlimited number of steps similar in principle to a slide-wire resistance. This gives perfect speed control from zero up to 1,800 stitches per minute. However, as this maximum speed is higher than practicable, an adjustable stop is provided so that the operator may easily adjust the maximum speed to suit her own requirements. Any speed from the maximum to the slight movement giving a single stitch, may be obtained. The acceleration is always smooth regardless of what speed is desired; there is no jerking and therefore no breaking of threads.

No brake is necessary, because the motor very quickly comes to rest, since the large flywheel required with foot power is not included in the drive. The motor is of the compensated universal type permitting it to be used on any 110-volt circuit whether it be direct current, 25, 60 or 133-cycle alternating current.

A very good idea of the compactness of the motor may be gained from the illustration, as the small size of the Wilcox & Gibbs sewing machine is well known.



Compact Electrically Driven Wilcox & Gibbs Sewing Machine.

Electrically Operated Motion Signs on Horse-Drawn Trucks.

A very unique method of advertising has been developed by the American Sugar Refining Company, of New York City, utilizing the large number of trucks that its Brooklyn plant operates.

The fifth of these trucks is now equipped and it is planned to have about 25 more within about two months.

There are three types of signs. No. 1, shown in Fig. 1, advertises Crystal Domino granulated sugar. This sign has a revolving disk which illustrates the sugar flowing from the standard carton to a large bowl.

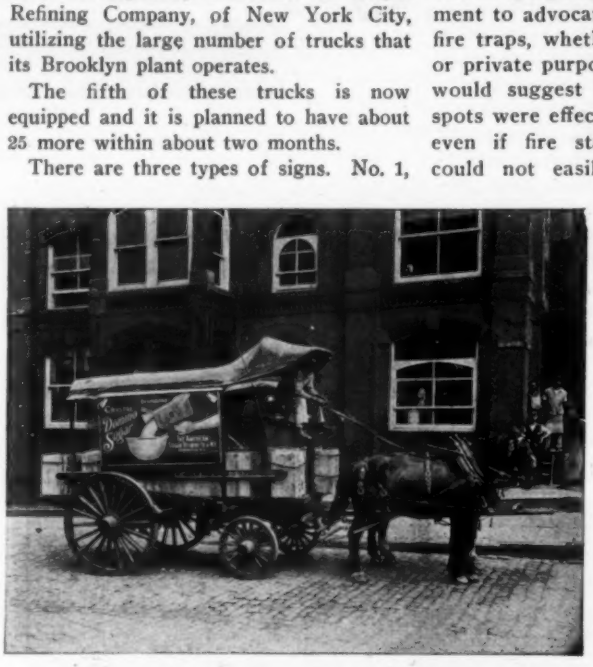


Fig. 1.—Appearance of Motion Sign on Truck.

Another sign shows the well known "Little Miss Crystal Domino" emptying a carton of Crystal Domino sugar tablets into a sugar bowl. Around this sign is a revolving disk with spiral colored stripes which give a rainbow effect.

The third sign advertises both granulated and tablet Crystal Domino sugar. The picture of the carton of the tablet sugar appears. Then this picture disappears and the granulated sugar carton appears in its place.

The mechanism of the signs is driven by a six-volt ball-bearing motor, made by the Robbins & Myers Company, Springfield, O. The motor runs at 1,000 revolutions per minute and takes 10 amperes. A 120-ampere-hour lead storage battery supplies the current. Fig. 2 shows the method of mounting the motor on the back of the sign. The battery is supported at the rear of the truck under the body.

The batteries are charged each night, twelve batteries being charged in series across 115-volt mains. Six sets of twelve charging receptacles are provided permitting 72 storage batteries to be charged at a time.

Four men are employed to maintain the batteries and signs, two on day and one at night. Considering the distribution obtained, this method of advertising has proven very inexpensive.

Safeguarding Fire Hazards in Old Buildings.

It is far from the purpose of anyone in sympathy with the safety movement to advocate the continued use of fire traps, whether for business, public or private purposes, but common sense would suggest that if certain danger spots were effectively protected so that even if fire started around them, it could not easily spread, the hazard would practically disappear so that the old buildings might quite well be continued in use.

Asbestos lumber has a great protective value even against actual flames, while as an insulation for protecting woodwork from the effects of heat, as found in boiler rooms and similar places, it offers almost perfect protection.

A boiler room ceiled and lined with Transite asbestos lumber is fire resistant to a high degree. The asbestos lining does not readily transmit heat, as does metal, and consequently the asbestos-protected woodwork does not acquire the tinder-like dryness of improperly insulated material, while in case of actual fire, the flames cannot readily pass the asbestos lining, nor does the woodwork readily char.

Where partitions are pierced for the passage of flues or pipes, an insulation panel is easily inserted, while a sheet of asbestos wood placed behind a radiator effectively protects the wall.

For electric switchboards, switch-

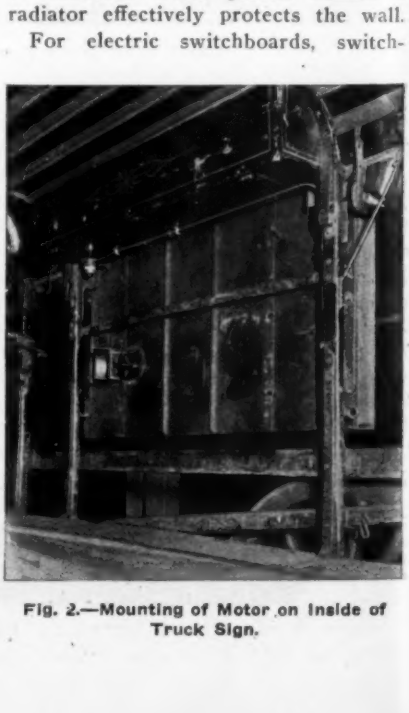


Fig. 2.—Mounting of Motor on Inside of Truck Sign.

boxes, partitions and other central-station installations working at high tension, it is advisable to use ebony asbestos wood which is entering largely into the equipment of central power stations all over the country.

By the judicious use of these two materials, in such places as indicated, many old buildings may be made safe without waiting for the order of the fire commissioner. It is far better and usually far cheaper to be prepared, than to wait until the commissioner issues his order.

The owner of a building in which every reasonable precaution has been taken against both the occurrence and spread of any possible fire is in a far stronger moral position than the man who has done nothing. In the one case he will be admitted to have done his best, with the result that his efforts are likely to be approved, while in the other the building may be condemned without any option.

Transite and ebony asbestos woods referred to herein are the products of the H. W. Johns-Manville Company, New York City.

Electric Signal Horns for Factories.

The accompanying illustrations shows two new factory signal horns placed on the market by the Benjamin Electric Manufacturing Company, 128 South Sangamon Street, Chicago, Ill. One represents the vibrator type, the other a direct-current motor-driven type. On the high-voltage direct-current vibrator horn a special condenser bridged across the magnet-coil winding is used. This precludes any arcing at the vibrator contacts inasmuch as the condenser absorbs the charge or kick-back from the coil caused by the breaking of the electric circuit. The alternating-current horn has only one moving element; there are no contacts or vibrator springs. It is furnished for any commercial voltage from 110 volts down, and for any frequency which may be specified.

Vibrator-Type Factory Horn.

The direct-current motor-driven horn may be used either for automobile or factory service. In the former case standard winding is for connection to a six-volt storage battery; in the latter case it can be furnished for voltages from 6 to 60 or higher, not to exceed 110. It is equipped with a skeleton-type ventilating motor. The armature is adjustable, taking up any possible wear on the ratchet wheel or diaphragm button. This is one of the most powerful medium-size horns on the market.

These horns may be used not only in combination with interior fire-alarm systems, but may also be operated as interior calling systems. They are approved by the National Board of Underwriters. Blue prints showing typical installations have been prepared for those interested in these devices for interior service.

Concentration Yard of Crawford Cedar Company.

In the construction of pole lines it is very frequently necessary to secure poles and other material on short notice in order to make urgent extensions or replace damage caused by storms. This imposes the requirement on the producer of pole-line materials of maintaining large and well sorted stocks at points provided with good shipping facilities.

In the accompanying illustration is shown the concentration yard of the Crawford Cedar Company at Menominee, Mich. This firm is one of the best known producers of cedar poles, ties, posts, piling. etc. The view shown includes about two-thirds of the yard, which contains piled up about 125,000 cedar poles 18 feet in length and about 1,000,000 posts ranging from 7 to 16 feet in length; there is also an accumulation of about 125,000 cedar and hemlock ties. In the background of the picture can be seen a large volume of material being removed from a raft in the waters of Green Bay. This material is being taken out, sorted and distributed into the respective piles by machinery for facilitating these operations. Included in this are two traveling derricks, an elevator scow hoist and endless chain tramways that are back of the mill.

Aside from the large concentration yard which the company maintains at Menominee, it also carries considerable stock at various operating points and landings along the lines of the Chicago & Northwestern, Chicago, Milwaukee & St. Paul, Wisconsin & Michigan, the "Soo" Line and the South Shore railroads.

Main Concentration Yard of Crawford Cedar Company.

Benjamin Motor-Driven Horn.

Noteworthy Electric Furnace Installations.

During the past two weeks the Snyder Electric Furnace Company, Chicago, Ill., has started up three basic furnaces at the plants of the Gerlinger Steel Casting Company, Milwaukee, Wis., Halcomb Steel Company, Syracuse, N. Y., and Dayton Steel Foundry Company, Dayton, Ohio. The Gerlinger furnace is the same type and size as those which were started up during September in the plants of the Niagara Electric Steel Corporation, North Tonawanda, N. Y., and S. Fair & Son, Inc., Saginaw, Mich. It has a 24-hour capacity of six tons. The Halcomb furnace has a 24-hour capacity of

30 tons, and the Dayton furnace a capacity of 10 tons.

Metal from the second blast of the Gerlinger furnace showed a tensile strength of 72,000 pounds, unannealed and 130,000 pounds annealed with an elongation of 20 per cent in two inches. The carbon content was 0.45 per cent. The Holcomb furnace poured good tool-steel ingots on the very first heat and is operating satisfactorily as designed and guaranteed.

Electric Sterilization of Milk.

The Electro-Pasteurized Milk Products Company is a new Columbus, O., enterprise. The Ohio state dairy inspector states that to his knowledge there is no other plant in the country where milk is sterilized by electricity. While conducting a plant for the sale of product in the usual way, the company has the larger object of demonstrating the process and apparatus which it has originated.

The milk flows by gravity through a series of porcelain cups. In the bottom of each cup is located an electrode which is connected with the main wire carrying an alternating current of 2,200 volts. The electrodes in two adjacent cups are connected to the opposite poles of the generator supplying the current, and as the milk flows out of the first cup into the one below it the electric circuit is thus closed, the milk serving as a conductor of the current from one electrode to the other, and so on through the series of cups, which gives pure milk with all bacteria eliminated.

Tests made by the city bacteriologist of Columbus, who is also a member of the Ohio State University faculty, have led him to announce the product of this plant to be absolutely sterile. Another local authority reports that a sample of milk examined by him three hours after it came from the cow disclosed 144,500 bacteria per cubic centimeter, and that a second examination made after the sample had passed through the electric process in question showed that there had been a removal of 144,494 bacteria, or over 99.99 per cent.

Whereas pasteurizing by heating requires half an hour and leaves the milk with a more or less disagreeable taste, the electric process does the work in about twnty seconds and enhances the natural flavor of the milk, it is claimed, without introducing any unnatural taste.

Greatest stress, however, is laid on the greater purity of the milk. The boiling process, it is stated, while destroying the active bacteria which are in the milk at the time, does not kill the spores which afterward develop into active bacteria. The electric purifying process not only kills the active bacteria, but from the continued application of the current as the milk flows from one cup to another develops these spores into active bacteria and seals their fate through the electric route.

The company is now treating about 300 gallons of milk a day, for which it is finding a ready sale. The output is soon to be increased, and the plant made into a model demonstrating place for dairymen and others who may become interested.

A New Sketching Sign.

A highly novel and interesting form of sign has recently made its appearance in London, where it is on show at several of the chief railway stations, according to *The Illuminating Engineer*.

The design is projected on to a large white sheet about 12 or 15 feet square,

Electric Sketching Sign.

which is erected high above the heads of people on the platform and can be seen from all parts of the station. The interesting thing about the sign is that each motto and drawing is sketched out before the eyes of the onlookers in the course of a few minutes. For example, in the illustration shown, the moving pen has finished sketching the figure and has nearly finished tracing the words "Flor de Dindigul." A picture is only shown for a few minutes and during each night a large variety of advertisements can be shown, a small weekly charge for each being made. The illustration gives an excellent idea of the vivid appearance of the sign, as contrasted with the dimly lighted station area.

The sign is worked as follows. The operator sits in a small inclosure a short distance away from the screen. Any desired picture is traced out on a brass plate by a small metal pencil, which is attached to two wires guiding an inking pen operating on a transparent sheet of gelatine paper. When the point of the pencil is applied to the brass plate an electric circuit is completed and the inking pen is thus brought in contact with the transparent paper. Then owing to the mechanical connection between the pen and the pencil any motion of the latter is reproduced exactly by the former. The drawing is thus traced out in ink on the transparent paper, which is situated in an arc light projector and is thereby thrown on the screen, forming an image of jet black lines on a brilliant white background.

The operator, while sketching out the drawing, keeps his eyes on the screen, and the public sees the whole design being sketched out by the pen, starting with a blank white sheet and ending with the finished drawing. After the sketch is completed a short time is allowed for it to be seen by the public, and then a new portion of the endless roll of transparent paper is substituted and the process begins over again.

The sign invariably attracts notice. It has already been tried for recruiting purposes at Liverpool and proved almost too successful—attracting a crowd which within a few minutes completely blocked the roadway!

A New Peat-Distillation Process.

A new process for the distillation of peat has recently been patented in Great Britain and other countries by which coke, fuel, oil, toluol, ammonia, paraffin wax, and acetone are obtained in sufficient quantities and of such high grade as to prove of great value. The process has been in practical operation now some six months and seems to promise to revolutionize the peat industry and to furnish sources of fuel oil to the British Navy which possibly make it independent of foreign oils.

The peat is first broken up in a macerator, compressed into briquets, dried to reduce the mosture content to 25 per cent and then fed by means of a worm-screw conveyor through a triple-chamber retort in which the successive chambers have increasing temperatures. The gases distilled off are condensed and the condensate separated.

With peat costing about 8 shillings ($1.95) per ton delivered in the hopper, dry, it is believed that by this process a profit of not less than 15 or 20 shillings ($3.65 or $4.87) per ton will be obtained; and this does not include any allowance for the toluol and acetone, which may prove to be more valuable than all the other products together.

Electric Taxicabs.

Electric taxicabs to the number of 700 will soon be operating in New York City.

Latest Approved Fittings

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

CONDUIT BOXES—Appleton Electric Company, 212 North Jefferson Street, Chicago, Ill.

Laundry outlet boxes with hinged and locked covers, catalog Nos. 1550-2 inclusive, 1560-2 inclusive, 1570-2 inclusive.

Also above types with steel or porcelain covers or with porcelain bushings.

Listed September 21, 1915.

CONDUIT OUTLET BUSHINGS AND FITTINGS. — National Metal Molding Company, Fulton Building, Pittsburgh, Pa.

Couplings for connecting flexible conduit, catalog Nos. 2188, 2189.

Listed September 8, 1915.

LAMP CLUSTERS.—Benjamin Electric Manufacturing Company, 120 South Sangamon Street, Chicago, Ill.

Adjustable socket clusters, 660 watts, 250 volts.

Keyless, catalog Nos. 867, 868, 869.

Pull or lever-key, catalog Nos. 855, 857, 877, 878, 879.

Listed October 27, 1915.

LIGHTNING RODS.—Boston Lightning Rod Company, 294 Washington Street, Boston, Mass.

Listed October 29, 1915.

PICTURE MACHINES AND APPLIANCES. — Non-Rewinding Film Reel Company, 713 Utica Street, Toledo, O.

Non-rewinding film reel and magazine. A special upper magazine and reel for motion-picture machines; so designed that by unwinding film from center of reel it can be repeatedly exhibited without rewinding it. A variety of supporting brackets are provided to make device attachable to any standard projecting machine.

Listed October 22, 1915.

RECEPTACLES, For Attachment Plugs.—The Bryant Electric Company, Bridgeport, Conn.

"Bryant" or "Perkins" heater control combinations.

10 amperes, 125 volts, catalog Nos. 514-15.

Listed October 21, 1915.

RECEPTACLES, For Attachment Plugs.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

Flush receptacles for use with standard Edison screw-shell attachment plugs.

C-H, 660 watts, 250 volts, catalog No. 7642.

Face plates, catalog Nos. 7643-4.

Listed October 15, 1915.

RECEPTACLES, For Attachment Plugs.—Harvey Hubbell, Incorporated, Bridgeport, Conn.

Surface type, 10 amperes, 250 volts, three-pole, catalog Nos. 6045, 6046, 6146; 20 amperes, 250 volts, three-pole, catalog No. 6055.

Flush type, 10 amperes, 250 volts, three-pole, catalog Nos. 6049, 6050, 6148.

Listed September 27, 1915.

RECEPTACLES, Standard. — The Arrow Electric Company, 103 Hawthorne Street, Hartford, Conn.

Arrow E, porcelain-shell receptacles.

Key, 250 watts, 250 volts.

Wall, cleat and concealed, catalog Nos. 4007-B, 4009-B.

Conduit box, catalog Nos. 4045-B, 4048-B.

Molding, metal or wood, catalog Nos. 4011-B, 4070-B, 4073-B.

Keyless, 660 watts, 250 volts. Sign or conduit box, catalog No. 102704.

Listed September 15, 1915.

RECEPTACLES, Standard.—Benjamin Electric Manufacturing Company, 120 South Sangamon Street, Chicago, Ill.

Benjamin, porcelain shell.

Keyless, 660 watts, 600 volts. Catalog Nos. 341, 342, 358.

Listed September 24, 1915.

RECEPTACLES, Standard. — The Bryant Electric Company, Bridgeport, Conn.

Bryant or Perkins metal shell, closed or slotted bases.

Keyless, 660 watts, 250 volts, catalog Nos. BX-13, BW-13.

Listed October 2, 1915.

RECEPTACLES, Standard. — The Bryant Electric Company, Bridgeport, Conn.

Bryant or Perkins metal shell, closed or slotted bases.

Key, 250 watts, 250 volts, catalog Nos. BW-10, BX-10, BW-11, BX-11.

Key, 660 watts, 250 volts, catalog Nos. BW-12, BX-12.

Pull, 250 watts, 250 volts, catalog Nos. BW-15, BX-15.

Twin pull, 660 watts and 250 watts, 250 volts, catalog Nos. BW-17, BX-17.

Turn, 250 watts, 250 volts, catalog Nos. BW-14, BX-14.

Also all of above types with shadeholders attached; key types with composition or insulated metal key.

Listed October 11, 1915.

RECEPTACLES, Standard. — The Bryant Electric Company, Bridgeport, Conn.

Bryant or Perkins. Keyless, porcelain shell. Conduit box, 660 watts, 250 volts, catalog No. 4108.

Listed October 11, 1915.

RECEPTACLES, Standard.—Weber Electric Company, Schenectady, N. Y.

Brass shell.

Key, 250 watts, 250 volts, catalog Nos. UK130 (1435), UK132 (1441), UK133 (1444), UK134 (1447).

Keyless, 660 watts, 250 volts, catalog Nos. 50717, 50718, UL130 (1436), UL132 (1442), UL133 (1445), UL134 (1448).

Pull, 250 watts, 250 volts, catalog Nos. UP130 (1437), UP132 (1443), UP133 (1446), UP134 (1449).

Also above types with shadeholders attached.

Key types with composition or insulated metal key.

Listed October 11, 1915.

RHEOSTATS. — The Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

"C-H" self-starter, bulletin No. 9765.

Listed September 25, 1915.

RHEOSTATS.—Monitor Controller Company, 111 South Gay Street, Baltimore, Md.

Automatic starting devices for direct-current motors.

Types Nos. 100-103 inclusive, 210-11, 215-16, 300-303 inclusive, 315-318 inclusive, 320-323 inclusive, 340-343 inclusive, 400, 405, 500, 501-02, 510-12 inclusive, 520-22 inclusive, 530-32 inclusive, 540-543 inclusive, 550-52 inclusive, 560-563 inclusive, 710.

Listed October 22, 1915.

SHADEHOLDERS. — The Bryant Electric Company, Bridgeport, Conn.

Bryant or Perkins.

Uno shadeholders. These shadeholders are designed to thread over spiral socket shells as supplied on Bryant or Perkins sockets or receptacles. Catalog Nos. 533, 534.

Listed September 15, 1915.

SIGNAL APPLIANCES.—Schwarze Electric Company, Adrian, Mich.

Schwarze electric bells for alarm and signalling systems. Single-gong, magneto, catalog No. 7.

Listed September 15, 1915.

SWITCHES, Push-Button Flush.—John I. Paulding, New Bedford Mass.

Single-pole, 5 amperes, 250 volts, 10 amperes, 125 volts, catalog No. 972.

Double-pole, 10 amperes, 250 volts, catalog No. 973.

Three-way, 5 amperes, 250 volts, 10 amperes, 125 volts, catalog No. 974.

Four-way, 5 amperes, 250 volts, 10 amperes, 125 volts, catalog No. 2971.

Listed October 25, 1915.

Current Electrical News

ATLANTIC STATES.

HOLYOKE, MASS.—The Board of Aldermen has voted in favor of a $100,000 bond issue, for the enlargement and improvement of the gas and electric light plants operated by the municipality. W.

ELBA, N. Y.—The Public Service Commission has authorized the Genesee Light and Power Company, of Batavia, to issue bonds to the amount of $10,000 for furnishing a new street-lighting system in Elba.

GOWANDA, N. Y.—The Gowanda Light and Power Corporation has been incorporated with a capital of $100,000. The directors are G. M. Gest, George A. Larkin and Edmund Wisnewski.

NORTH CENTRAL STATES.

DECATUR, ILL.—On his bid of $3,397.80, J. P. McGarry was awarded the contract for installing ornamental lights on North Water Street. Z.

KANKAKEE, ILL.—Tungsten lamps will replace the arc lights now in use for street-lighting at Kankakee, if plans being discussed by the city councilmen and officials of the Kankakee Public Service Company are carried out. It is proposed to put in the new lamps and have one at every street intersection. Z.

FOX LAKE, WIS.—A resolution has been passed granting a right to the Fox Lake Light and Power Company to erect and operate an electric lighting system in village. Address R. O. Williams, president.

MENOMINEE, WIS.—The Lannon Light and Power Company has been incorporated with a capital of $15,000, by W. C. Leitzke, A. H. Christman, and others.

ROCHESTER, MINN. — Specifications have been issued by the Charles L. Pillsbury Company, engineers, 805-811 Metropolitan Life Building, Minneapolis, Minn., for power plant equipment for a new municipal electric power plant. A new $45,000 power-plant building is now being erected and new machinery together with a part of the equipment from the old power plant is to be installed. The new plant will have a capacity of 1,725 kilowatts in generators and 1,040 boiler-horsepower. Bids will be received by the Public Utility Board at Rochester, W. F. Lenz, Secretary, until 10 a. m., December 8, 1915, for equipment installed as follows: Two 260-horsepower water-tube boilers, mechanical stokers for four boilers; ecomonizers and induced draft fan equipment; chimney; steel breeching and flues; overhead coal bunkers; coal crusher and conveying equipment; 750-kilowatt turbogenerator and condenser; switchboard; condenser for two engines; crane for engine room; electric elevator; industrial rail and ash car. Proposals can be made on any division or on any part or parts of the entire equipment.

SOUTH CENTRAL STATES.

RUSH SPRINGS, OKLA.—An electric light plant will be installed by the council. Address mayor.

ATLANTA, TEX. — The Atlanta Electric and Ice Company is preparing to build a new electric light plant here. D.

DALLAS, TEX.—The City Commissioners have passed an ordinance reviving in favor of E. P. Turner and associates a franchise for interurban trackage in Dallas granted to J. Mercer Carter in 1906. The Dallas Northwestern Company and Dallas Southwestern Traction Company, projecting interurbans to Denton and Glen Rose, hold the franchise. It provides that work must be begun on the lines within six months after passage of the ordinance and that twenty miles of line must be completed within 15 months.

HOUSTON, TEX. — The complete properties of the Brunner Water and Light Company have been sold by the receiver, A. J. Binz, to W. H. Ostenburg for $14,900. The property consists of an electric light plant and a waterworks plant, both of which are situated in Brunner.

M'KINNEY, TEX.—The citizens of the town will vote on the question of the sale of the municipal electric plant here to the Texas Power and Light Company. There are at present two competing plants in the town, neither of which is paying.

NORTH PLEASANTON, TEX.—The North Pleasanton Ice and Electric Company will build an electric-light plant here to cost about $25,000. L. B. Myers is interested. D.

PLAINVIEW, TEX. — The Texas Utilities Company, which has just been organized with principal office here, and having a capital stock of $250,000, has taken over the electric light and power plants at Plainview and Lubbock. It plans to invest about $1,000,000 in enlarging the plants and constructing transmission lines through a big scope of territory around the towns for the purpose of furnishing power to farmers for operating irrigation pumping plants and other industrial enterprises. The incorporators are E. M. Kurtz, H. W. Beck, H. Wurdack, of St. Louis, Mo. Mr. Wurdack is president of the company. D.

WESTERN STATES.

HAILEY, IDAHO.—Ferris Brothers, of Wisconsin, who own several electric power plants in the west, have purchased the local plant from the Hailey Electric Company, and are also negotiating for the Rockwell-White power plant at Bellview. When this deal is complete, the two plants will be merged, and will be managed by John T. Hart, who has had charge of the Hailey plant for the past two years. The capacity of the two plants will be enlarged, and mining properties in the vicinity of Hailey will be furnished with power. O.

RATHDRUM, IDAHO.—The plant of the Rathdrum Electric Company, formerly owned by A. O. Skinner, which includes the lighting, heating and power systems at Post Falls, has been sold to Ralph Y. Poole, of Ouary, Colo., and according to reports extensions and improvements will be made by the new owner. O.

TACOMA, WASH. — The Puget Sound Traction, Light and Power Company, operating the Tacoma Railway and Power Company, with head offices in Seattle, has been granted a franchise by the Pierce County Commissioners to erect poles and wires for electric transmission from Sumner to surrounding territory, and to Orting and a short distance beyond, covering practically all of the Puyallup Valley.

POULSBO, WASH.—The County Commissioners have granted the Poulsbo Light & Power Company a franchise to construct an electric power plant and to erect and maintain transmission lines in all portions of Kitsap County.

INDEPENDENCE, ORE. — A. L. Martin, local manager of the Oregon Power Company, reports his company will extend its transmission lines to Buena Vista, south of Independence, for the purpose of getting electric service to Buena Vista, and farming districts in between. O.

LA PINE, ORE.—Thoms Brothers, of Nebraska, affiliated with other eastern capital, recently purchased the power plant and properties of the Pringle Falls Water and Power Company, of La Pine. This company also maintains offices in Portland. It is understood the purchasers paid $300,000 for the property. The new company plans to supply power for the irrigation of the entire La Pine basin, and Eden-Coulee, Silver Lake, and Fort Rock Valleys. It is reported the first step in the development will be the furnishing of power and light to the town of La Pine. Work on the power plant is practically completed, and electrical equipment for the generation of current will be purchased and installed at an early date. O.

PRAIRIE CITY, ORE.—Announcement has been made by the Prairie Power Company that work will be commenced at once on the extension of its

SALEM, ORE.—The North Coast Power Company, of Vancouver, Wash., has filed articles of incorporation to do business in the state of Oregon, taking over the properties of the Washington & Oregon Utilities Company. The capital stock is $1,750,000.

NEW INCORPORATIONS.

LIBERTY, ILL.—The Liberty Electric Company has been organized with a capital of $2,500, by Steven G. Lawless, M. E. Graff and W. E. Merce.

CHAFFEE, N. Y. — The Chaffee Electric Corporation has been established with a capital of $5,000, by A. J. O'Dell, R. B. Fisher and J. G. Aleen.

NEW YORK, N. Y.—Superb Electrical Manufacturing Corporation. Capital, $2,000. Incorporators: Joshua Bernstein, Jacob Lichtenstein and David Price.

BROOKLYN, N. Y.—G. and G. Electrical Company, Incorporated. Capital, $1,000. Incorporators: Benjamin Gadofsky, Hyman Cohen and Morris Whinston.

ROCHESTER, N. Y. — Electric Panel Board Company, Incorporated. Capital, $5,000. Incorporators: John B. Tucker, William J. Pierce and Chester Y. Macdonald.

WAYNESBORO, VA.—Price Electric Devices Corporation. Electrical supply business; capital, $150,000. Incorporators: W. G. Ellerson, president; E. L. Eakle, secretary.

NEW YORK, N. Y.—Western Electric Company, Incorporated; electrical appliances, equipment, etc. Capital, $750,000. Incorporators: George J. Pratt, Thomas J. Perkins and John H. Peck.

CHICAGO, ILL. — The Absolute Contact Company has been incorporated to manufacture and deal in motorless electrical sign flashers and electrical devices. The company's capital stock is $50,000. John D. Clancy, L. M. Clancy and M. C. Ryan are the incorporators. Z.

FOREIGN TRADE OPPORTUNITIES.

[Addresses may be obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch offices at Boston, New York, Atlanta, Chicago, St. Louis, New Orleans, Seattle and San Francisco. Write on separate sheet for each item and give file number.]

NO. 19,259. ELECTRIC METERS AND TRANSFORMERS.—A firm in Spain informs an American consular officer that it desires to be placed in touch with manufacturers of electric meters, transformers, bells, electric-light carbons, lamps, and all kinds of electric specialties. Correspondence may be in English.

NEW PUBLICATIONS.

NITROGEN IN COAL.—The Bureau of Mines has issued Technical Paper 64 entitled "Determination of Nitrogen in Coal," by A. C. Fieldner and C. A. Taylor. This compares different methods and indicates the sources of error.

HARDENED STEEL.—An article by Charles F. Brush entitled "Spontaneous Generation of Heat in Recently Hardened Steel" has been reprinted from the *Proceedings of the American Philosophical Society*. It shows that such heat generation is accompanied by changes in volume.

SMELTING IRON ORES.—The Canadian Department of Mines has issued a report by Alfred Stansfield entitled "Electrothermic Smelting of Iron Ores in Sweden." This describes the furnaces used, the nature of the ore and product, number of men employed, cost, etc., and gives an estimate of the cost of similar work in Canada.

TERRESTRIAL MAGNETISM.—The United States Coast and Geodetic Survey has issued publications Nos. 25 and 33 by Daniel L. Hazard. The first of these gives the results of magnetic observations made in 1914 on both land and sea. The second gives the distribution of magnetic declination in the Unitel States for January 1, 1915, with a chart and tables showing the secular change.

FINANCIAL NOTES.

The Consumers Power Company of Michigan, the principal generating subsidiary of Commonwealth Power, Railway and Light Company, has filed in Michigan a mortgage securing an authorized bond issue of $35,000,000 with the Harris Trust & Savings Bank, Chicago, as trustee. The new mortgage and the bonds under it are secured by liens on the entire property of the company and takes the place of the present collateral mortgage. The filing of the new mortgage is one of the final details in the plans of the company by which Consumers Power holds all its properties in fee, instead of through ownership of underlying stocks and bonds.

Dividends.

	Term	Rate	Payable
Con. Gas, Elec. Lt. & Pw., Balt., com.	Q	1.75%	Jan. 3
General Elec.	Q	2 %	Jan. 15
No. Ohio Trac.	Q	1.25%	Dec. 15
Rochester Ry. & Lt., pf.	Q	1.25%	Dec. 1
Shawnigan Water & Pw.	Q	1.75%	Jan. 10
Standard Gas & Elec., pf.	Q	1 %	Dec. 15

Reports of Earnings.

VIRGINIA RAILWAY & POWER.

	1915	1914
October gross	$ 473,073	$ 446,704
Net earnings	254,711	234,390
Total income	264,013	241,352
Surplus after charges	120,709	107,620
Balance after depreciation	112,376	99,286
Four months' gross	1,816,634	1,761,703
Net earnings	946,247	914,813
Total income	980,918	942,692
Surplus after charges	407,939	399,002
Balance after depreciation	374,606	365,669

DAYTON POWER & LIGHT.

	1915	1914
October gross	$ 99,239	$ 82,225
Net	50,347	37,814
Surplus	31,695	20,412
10 months' gross	855,391	756,588
Net	408,887	338,305
Surplus	227,592	166,199
12 months' gross	1,042,123	924,905
Net	497,594	416,430
Surplus	280,757	209,980

CONSOLIDATED COMPANY, BALTIMORE.

Consolidated Gas, Electric Light & Power Company, of Baltimore, the $11,472,334 common stock of which was recently listed on the New York Stock Exchange is a good example of the possibilities of development in gas and electric light and power corporations. The growth of the company from 1910 to 1915 inclusive was as follows:

	Year Ending June 30, '15	Year Ending June 30, '10	P. C. Inc.
Income from electricity	$3,301,199	$1,753,167	88
Income from gas	$3,374,915	$2,926,332	15
Electric customers	38,419	14,995	156
Electric sales in kilowatt-hours	126,933,209	37,790,200	236
Gas customers	121,866	96,416	26
Gas sales in cubic feet	4,199,790,500	2,934,872,100	43
Gas ranges in use	102,874	59,628	73
Water heaters in use	25,712	13,220	94

Income accounts for the last four fiscal years ending June 30, compare as follows:

	1915	1914	1913	1912
Total gross income	$6,789,401	$6,400,896	$6,114,973	$5,465,287
Expenses and taxes	3,576,583	3,333,821	2,963,180	2,642,887
Net	3,212,818	3,067,074	3,151,792	2,822,399
Interest on funded debt, etc.	1,640,361	1,567,689	1,476,767	1,417,267
Surplus for dividends and reserves	1,572,457	1,499,385	1,675,025	1,405,131

Electric maximum rate reduced 1.5 cents per kilowatt-hour July 1, 1913. Electric power contracts closed since 1911 amount to 68,517 horsepower of which 37,312 horsepower represents steam power supplanted by electric power. Industrial gas sales also have increased largely.

CITIES SERVICE COMPANY.

	1915	1914
October gross	$ 411,505	$ 300,212
Net after expenses	397,182	289,821
Surplus after charges	356,348	248,988
Balance after preferred dividends	225,515	112,155
12 months' gross	4,232,915	3,940,940
Net after expenses	4,069,412	3,837,884
Surplus after charges	3,579,412	3,441,217
Balance after preferred dividends	*2,003,416	1,799,224

*Equivalent to 13.61 per cent on common stock as compared with 11.45 per cent for the preceding 12 months.

Combined earnings of the subsidiary companies for the 12 months ended September 30, 1915, were $21,275,616.

REPUBLIC RAILWAY & LIGHT.

	1915	1914
October gross	$ 276,356	$ 251,893
Net after taxes	109,944	87,877
Total income	110,050	88,199
Surplus after charges	51,135	31,056
Balance after preferred dividends	25,178	5,099
Ten months' gross	2,514,277	2,500,002
Net after taxes	972,351	949,256
Total income	973,641	951,234
Surplus after charges	396,595	386,729
Balance after preferred dividends	137,025	127,159

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Nov. 22	Nov. 15
American Tel. & Tel. (New York)	128½	127⅞
Commonwealth Edison (Chicago)	144	144
Edison Electric Illuminating (Boston)	240½	238
Electric Storage Battery common (Philadelphia)	67	67
Electric Storage Battery preferred (Philadelphia)	67	67
General Electric (New York)	174⅞	177½
Kings County Electric (New York)	125	120
Massachusetts Electric common (Boston)	7	7
Massachusetts Electric preferred (Boston)	39	41
National Carbon common (Chicago)	116	155
National Carbon preferred (Chicago)	120	119¾
New England Telephone (Boston)	132	132
Philadelphia Electric (Philadelphia)	27⅝	27⅝
Postal Telegraph and Cables common (New York)	80	82
Postal Telegraph and Cables preferred (New York)	65	65½
Western Union (New York)	87¾	87⅝
Westinghouse common (New York)	67½	69⅞
Westinghouse preferred (New York)	—	—

PERSONAL MENTION.

MR. J. L. S. SCUDDING, acting superintendent of the Fort Madison Electric Company, Fort Madison, Iowa, has resigned to take charge of the meter department of the Mississippi River Power Company, Keokuk, Iowa.

MR. C. E. PATTON, president of the Curwensville Light & Power Company, Curwensville, Pa., has been appointed Secretary of Agriculture of the State of Pennsylvania.

DR. MILLER REESE HUTCHISON, chief engineer for Mr. Thomas A. Edison, has been appointed by Secretary of the Navy Josephus Daniels to a position on the Naval Advisory Board, which is headed by Mr. Edison. Dr. Hutchison is himself an inventor and in naval matters is particularly well informed on the matter of submarine mines and their control. He was engaged in this branch of harbor and coast defense during the Spanish-American War.

MR. J. D. MOONEY has been appointed sales manager of the Commercial Department of the Hyatt Roller Bearing Company. In the past Mr. Mooney has been in charge of belting sales for the B. F. Goodrich Company, Akron, Ohio.

MR. CHARLES R. UNDERHILL, chief electrical engineer of the Acme Wire Company, New Haven, Conn., has completed his second lecture course through the Middle West this season, having lectured on "Electromagnets" at Purdue University, November 9; University of Illinois, November 10 and November 11; Ohio State University, November 12; Engineers' Club, Dayton, November 15; Case School of Applied Science, November 16; University of Cincinnati, November 18, and Engineers' Club, Cincinnati, November 18.

OBITUARY.

MR. EUGENE HARTMANN, founder and director of the Hartmann & Braun Actien-Gesellschaft, died at Munich, Germany, on October 18. The decreased was a past-president of the Verband Deutscher Elektrotechniker.

DATES AHEAD.

American Society of Mechanical Engineers. Annual meeting, New York City, December 7-10. Secretary, Calvin W. Rice, 29 West Thirty-ninth Street, New York City.

National Independent Telephone Association. Annual convention, Hotel La Salle, Chicago, December 8-10. Secretary, F. B. MacKinnon, Washington, D. C.

American Association of Engineers. First annual convention, Hotel La Salle, Chicago, Ill., December 10-11. Secretary, Arthur Kneisel, 29 South La Salle Street, Chicago, Ill.

American Association for the Advancement of Science. Annual meeting, Columbus, O., December 27-31. Secretary, L. O. Howard, Washington, D. C.

American Institute of Chemical Engineers. Winter meeting, Baltimore, Md., January 12-15, 1916. Secretary, J. C. Olson, Cooper Union, New York, N. Y.

With the Electrical Manufacturers

Lee Electric Radiator Company, 335 Wells Street, Chicago, Ill., manufacturer of a line of electric circulatory radiators, has opened an office at 1019 Post Street, Seattle, Wash., to enable it to handle more expeditiously its western business.

The Standard Electric Tool Company, Cincinnati, O., has issued Bulletin G, which brings the latest information of its high-power portable ball-bearing electric grinders. These are made in various types, all of which are fully illustrated and described.

Belden Manufacturing Company, Western Avenue and Twenty-Third Street, Chicago, Ill., has issued a new discount sheet (No. 165) applying to its catalog No. 6. This gives discounts and various base prices for its wires and cables.

Century Electric Company, Nineteenth, Pine and Olive Streets, St. Louis, Mo., has issued an attractive circular entitled "The Little Tots." This deals with Century fractional-horsepower single-phase motors. It points out their merits, particularly the high starting torque combined with low starting current, and shows a number of typical applications of these motors.

Stow Manufacturing Company, Binghamton, N. Y., has issued bulletin No. 33, which describes the Stow flexible grinder, which is built especially for use in the steel industry and allied trades. The motor shaft combination is mounted on a truck, making it possible to transport it readily to any part of the shop. A very large number of these sets are in successful use in the leading steel mills.

The Barber Electrical Manufacturing Company, North Attleboro, Mass., has been organized to manufacture switchboards, switches and cutouts. The company organized with H. C. Barber, president; William W. Plattner, secretary; Charles E. Riley, treasurer. The directors will include Frank Mason, Charles E. Riley, Orin W. Clifford, H. C. Barber, Alton H. Riley, Louis E. Freeman and Ernest T. Upham.

The N. W. Dunton Company, 150 Niagara Street, Providence, R. I., advises that the 32-page book on "Soldering Kinks," which was mentioned in these columns in our November 13 issue, is supplied for 25 cents. This book contains 69 valuable suggestions on soldering, many of which relate to electrical products. The company also issues posters that may be tacked up over the work bench; these contain 22 soldering kinks. Copies of the latest poster can be obtained by sending two cents to cover cost of mailing.

Reynolds Electric Company, 422 South Talman Avenue, Chicago, Ill., has issued bulletin No. 33, dealing with some types of Reco flashers. The types described and illustrated particularly are the simple off-and-on type in various sizes; the script type used in script-letter signs, fancy borders, arrow and rocket effects; a special low-priced simple flasher for small signs; the Reco motor made in sizes from one-twentieth to one-sixth horsepower for driving flashers and other small machines; and Reco color hoods for obtaining natural colors with ordinary incandescent lamps.

Industrial Controller Company, Milwaukee, Wis., has issued handbook No. 4 on I-C controlling devices. This book contains 184 pages and is devoted to direct-current motor starters and speed regulators, alternating-current motor starters and speed regulators, direct-current automatic starters, and speed regulators, accessories to the foregoing, battery-charging resistance units and field rheostats. Nine pages give National Electrical Code wiring and motor data and eight pages are devoted to the telegraphic code and indexes. The book is well illustrated and gives complete descriptions and data on each control device listed.

Hyatt Roller Bearing Company, Newark, N. J., announces that on account of the rapid increase in its business it is adding three new large buildings to its factory. These structures when completed will give the company a total of over 600,000 square feet of floor space devoted exclusively to the manufacture of roller bearings, making this the largest plant of its kind in the world. One of these buildings is designed for heat-treating processes and is 90 by 110 feet in area and six stories high. The other two buildings are each 200 by 50 feet in dimensions and eight stories high. These will be used for the press work, assembly of roller-bearing parts and shipment. A very complete and elaborate system of ventilation is being provided for the heat-treating building.

The Shaw Insulator Company, 207 Market Stret, Newark, N. J., has completed a plant for the molding of composition into insulating parts for all electrical purposes. The company announces that the most modern machinery has been installed. H. M. Shaw, president of the company, states that the men in charge of the plant have been in the insulation business for the past 25 years. The insulation is manufactured from carefully selected materials tested in laboratory and actual service, and is claimed to be free from "excessive contraction, moisture absorption, varied dielectric strength, carbonization, mechanical imperfections, surface leakage, is impervious to acids and will exceed standard requirements for heat. Has luster finish and a toughness and elasticity to with-

stand electrical and temperature changes without cracking or breaking. Age and service increases its efficiency."

Harrison Safety Boiler Works, Philadelphia, Pa., has issued a 68-page book devoted to the use and design of Cochrane meters. It is entitled "Finding and Stopping Waste in Modern Boiler Rooms." The value of feed-water and condensate meters as aids in the management of power plants is taken up in detail, covering among other factors grade of fuel, grates, methods of firing, air leaks, control of draft, condition of gas passages, scale and soot on boiler tubes, radiation, etc. With a feed-water meter installed, it becomes possible to measure the effect of changes in connection with these several factors. The means of obtaining the desired result having been ascertained, the manager or engineer is in position to insist upon good results continuously, since the facilities for continuous quantitative measurements and records are afforded by these meters. In the subsequent sections of the book, the Cochrane metering heater (combined open feed-water heater and hot-water meter), with its several modifications, is described in detail, as also the Cochrane flow recorder for use in connection with V-notch weirs. In the last pages of the book a new type of meter, working on the volumetric principle, by means of which it is possible to obtain an accuracy of within one-third of one per cent, is described.

Allis-Chalmers Manufacturing Company, Milwaukee, Wis., has issued a number of new bulletins, of which two have considerable interest to engineers of power development and transmission companies. Bulletin No. 1097 deals with power transformers which the company makes in three types. These are oil-filled self-cooled; oil-filled water-cooled; and air-blast; each of these is made in single-phase or three-phase form. The method of construction is described in considerable detail, with numerous illustrations of parts and of typical installations, both indoors and outdoors. These transformers are built for voltages up to 150,000. Bulletin No. 1636 is a 56-page publication on hydraulic machinery. A number of illustrations are shown of hydroelectric plants for which Allis-Chalmers hydraulic equipment and in several cases also the generators were furnished. The various types of hydraulic turbines, particularly the Francis and impulse types, are described and liberally illustrated. These machines are made for practically any head and for vertical or horizontal shafts. The company is in position to build all kinds of hydraulic and electrical generating equipment to best suit the particular conditions, for which an engineering department is maintained to make a complete study of each development contracted for. Governors and other auxiliaries are also described.

Record of Electrical Patents

Issued by the United States Patent Office, November 16, 1915.

Prepared by Thomas Howe, Patent Attorney, 2 Rector Street, New York, N. Y.

1,160,125. **Dictograph Intercommunicating Telephone System.** W. P. Andrick, assignor to General Acoustic Co., Jamaica, N. Y. Has master station and substations.

1,160,129. **System of Automatic Block Signaling for Railways.** G. H. Benjamin, New York, N. Y. Comprises co-operating car and track coils.

1,160,133. **Means For Circulating Electrolyte.** W. L. Bliss, assignor to U. S. Light & Heat Corporation, Niagara Falls, N. Y. Is simultaneously circulated in several cells of storage battery.

1,160,142. **Combined Frog and Switch for Overhead Trolleys.** H. Crist, Scalp Level, Pa. Knife switch on frog structure.

1,160,169. **Method of, and Apparatus for, Heating Fluid Material.** C. Hering, Philadelphia, Pa. Solidification of molten material controlled by passing current.

1,160,177. **X-Ray Tube.** E. W. Kelly, assignor to Snook-Roentgen Mfg. Co., Philadelphia, Pa. Cooling medium through electrode.

1,160,181. **Machine Telephone Switching System.** F. R. McBerty and D. Koenig, assignors to Western Electric Co., New York, N. Y. Sending mechanism and relay control.

1,160,187. **Plug-Receptacle Box for Electric Circuits.** W. F. Meschenmoser, New Dorp, N. Y. For mounting behind wall plate.

1,160,188. **Signal-Transmitter.** C. Miller, assignor to Edwards & Co., New York, N. Y. Call-box mechanism.

1,160,243. **Wigwag Flagman.** J. A. Bell, C. R. Twitchell and D. M. Palmer, assignors to Railway Specialties Co., Los Angeles, Cal. Crossing signal oscillated by electromagnets.

1,160,244. **Treating Materials in Electric Furnaces.** E. S. Berglund, Trollhättan, Sweden. Easily fusible slag introduced at intervals.

1,160,261. **Method of Electric Welding and Apparatus for Use Therein.** W. B. Cleveland, assignor to Electric Railway Improvement Co., Cleveland, O. Work clamped between electrically heated blocks.

1,160,268. **Gramophone.** R. W. de la Rue, Newmarket, England. Sound arm opens motor circuit to stop.

1,160,289. **Electrical System of Distribution.** J. W. Jepson, assignor to Gould Coupler Co., Depew, N. Y. Voltage regulation in battery system having variable-speed generator.

1,160,294. **Selective Signaling System.** O. M. Leich, assignor to Cracraft, Leich Electric Co., Genoa, Ill. Has polarized harmonic ringer.

1,160,315. **Elevator Signaling Apparatus.** E. R. Newell, assignor to Elevator Supply & Repair Co., Chicago, Ill. Time when signal can be given controlled by passenger's button and gate mechanism.

1,160,327. **Homogenizing and Heating Device for Gaseous Fuel.** E. P. Ross, Freeport, N. Y. Gasket has heating resistor wire.

1,160,344. **Electrical System of Distribution.** W. A. Turbayne, assignor to Gould Coupler Co. Includes multi-voltage generator.

1,160,345. **Convertible Direct or Indirect Lighting Fixture.** F. W. Wakefield, assignor to F. W. Wakefield Brass Co., Vermilion, O. Reflector normally above may be adjusted to form bowl below lamp.

1,160,346. **Clock Mechanism.** H. E. Warren, Ashland, Mass. Pendulum magnetically connected with time train.

1,160,356. **Apparatus for Determining the Speed of Rotation of Impulse-Transmitters.** A. H. Adams, assignor to Western Electric Co. For automatic telephone exchanges.

1,160,357. **Electrical Transformer.** R. F. Agnew, assignor to Agnew Electric Welding Co., Detroit, Mich. Structure of secondary.

1,160,371. **System for Operating Burners by Means of Liquid Fuel.** C. A. Brown, Hinsdale, Ill. Electrical heating and feeding of fuel.

1,160,386. **Fuse Carrier.** J. J. Crouse, Waterbury, Conn. Insures good contact of fuse with terminal clips.

1,160,388. **Ignition Apparatus for Internal-Combustion Engines.** L. C. Daucher, Suresnes, France. Regulatable gaps in parallel with spark plugs.

1,160,400. **Electrolytic Process of Detinning.** H. Goldschmidt, assignor to Goldschmidt Detinning Co., New York, N. Y. Tin scrap placed in alkaline bath to which electrolyte and electrolysis is applied.

1,160,401. **Electrolytic Detinning System.** H. Goldschmidt, assignor to Goldschmidt Detinning Co. Apparatus for above.

1,160,416. **Selective Controller for Vehicle-Call Systems.** J. H. Kliegl, New York, N. Y. "Talking" number sign.

1,160,422. **Electric Fire-Engine System.** C. Loeffler, Philadelphia, Pa. Contact controlled by valve of water plug.

1,160,428. **Art of Metal Working.** G. E. Markley, Cleveland, O. Manner of uniting rotor bars to end rings.

1,160,431. **Process for Producing Aluminum From Clay, Kaolin, and Other Aluminum Silicates.** G. Mellen, assignor of one-half to United Aluminum Ingot Co., New York, N. Y. Cyclic process comprising electrolysis and reusing exhausted sodium-fluorid-containing electrolyte.

1,160,435. **Electric-Lamp-Retaining Device.** H. J. Morey, assignor to Pass & Seymour, Inc., Solvay, N. Y. Spring wire engaging socket and lamp base prevents vibration of latter.

1,160,447. **Machine Telephone-Switching System.** L. Polinkowsky, assignor to Western Electric Co. Circuits and contacts of automatic selecting switch.

1,160,461. **Display or Advertising Clock.** W. Swank, Altoona, Pa. Comprises electrically controlled time balls and seconds lamps.

1,160,466. **Electric Automobile-Clock.** W. H. Thompson, assignor to Electric Clock Co., Memphis, Tenn. Spring-driven gearing and electric contacts.

1,160,469. **Machine for Producing Electrical Coils.** C. R. Underhill, assignor to Acme Wire Co., New Haven, Conn. Wire and insulation strip wound into coils.

1,160,472. **Device for Regulating the Speed of Motor Cars.** J. G. Wallmann, Oakland, Cal. Manual and automatic electromagnetic control of passage of air from manifold to brake cylinder.

1,160,488. **Electrical Resistance.** C. O. Bastian, London, England. Unit for use at high temperatures.

1,160,485. **Apparatus for Extracting Precious Metals.** V. I. Zachert, San Francisco, and P. A. Brangier, Agnew, Cal., assignors of one-third to V. G. Bonaly. Continuous electrical amalgamator.

1,160,491. **Battery.** P. Brown, Springfield, Mass. Vent provided for secondary cell without danger of leakage when cell is tipped.

1,160,496. **Burglar and Signal Device.** A. Casper, Vallejo, Cal. Doorknobs control electromagnetically operated "In" and "Out" plates.

1,160,514. **Method of Regulating Boiler-Pressure.** P. O. Keilholtz, Baltimore, Md. Hunting prevented in electric regulation of fuel and air supply in mechanical-draft system.

1,160,518. **Pocket Flashlight.** A. S. Byhne, Bridgeport, Conn. Pistol-shaped; controlled by trigger.

1,160,524. **Oxygen Generator.** W. F. Muehl, Syracuse, N. Y. Electrically heated chemical receptacle in gas tank.

1,160,531. **Attachment Plug.** H. P. Rounds, Detroit, Mich. Has eccentric collar for locking in socket.

1,160,543. **High-Voltage Strain Insulator.** L. Steinberger, Brooklyn, N. Y. Chain-type insulator.

1,160,544. **Insulating Support for High-Tension Conductors.** L. Steinberger. Combination of rod-type and chain-type insulators.

1,160,545. **Mouthpiece.** L. Steinberger. For telephone transmitter.

1,160,547. **Disk Strain Insulator.** L. Steinberger. Combination of ribs on disk.

1,160,547. **Electrical Connection for Electric Relays.** C. Stille, Zehlendorf-West, near Berlin, Germany. Microphone relay device.

1,160,556. **Tension Apparatus.** G. S. Williamson, New York, N. Y., and C. E. Mandelick, Ridgefield Park, N. J. Braking generator on web-tension mechanism.

1,160,567. **Method of, and Means for, Calibrating Electric Meters.** O. T. Blathy, Budapest, Austria-Hungary. Field of electrodynamic brake is varied.

1,160,570. **Prepay Box for Use in Telephone Systems.** O. Brisbois, assignor to

J. H. Ware, Chicago, Ill. Entry of coin prevented except under proper conditions.

1,160,585. Fuel-Supplying Means. T. A. Edison, Jr., Burlington, N. J. Comprises electric heater for mixture.

1,160,608 and 1,160,609. Electrical System of Distribution. A. S. Hubbard, assignor to Gould Storage Battery Co. First patent: regulation of charge and discharge of floated battery; second patent: substation regulation.

1,160,610. Alternating-Current Apparatus. A. S. Hubbard, assignor to Gould Storage Battery Co. Current rectified by arrangement of series transformers and asymmetric cells.

1,160,615. Aiming Device. H. Jacob, assignor to firm of Optische Anstalt C. P. Goerz Aktiengesellschaft, Friedenau, near Berlin, Germany. Arrangement of lamp filament in Galilean double telescope.

1,160,619. Electric Attachment Device. C. J. Klein, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. Flush receptacle and plug.

1,160,620. Electric Switch. C. J. Klein, assignor to Cutler-Hammer Mfg. Co. Multiple-contact snap switch.

1,160,660. Mining Machine. J. Secrist, Nuttallburg, W. Va. Driving gear between motor and cutter and cable drums.

1,160,661. Incandescent Lamp. F. Skaupy, assignor to General Electric Co., Schenectady, N. Y. Amorphous carbon containing halogen in tungsten lamp to prevent obscuring deposits on bulb.

1,160,671. Apparatus for Printing Cinematograph Films. J. E. Thornton, Rochester, N. Y. Utilizes mercury-vapor lamps.

1,160,673. Series-Parallel Control System. J. F. Tritle, assignor to General Electric Co. For number of pairs of motors.

1,160,674. System of Control for Electric Motors. J. F. Tritle, assignor to General Electric Co. Contactor control for four motors.

1,160,678. Electric Control for Elevators. A. Ward, Greystone, R. I. Elevator door controls pilot motor for controller.

1,160,679. Flow Meter. J. Wilkinson, assignor to General Electric Co. Electrically operated indicating pendulum controlled by flow pressure.

1,160,684. Electric Percolator. H. P. Ball, assignor to General Electric Co. Arrangement of electric heater, fountain, etc.

1,160,702. Insulator. G. Faccioli, assignor to General Electric Co. Oil filled; for mounting in tank wall.

1,160,705. Method of, and Means for, Operating Synchronous Dynamo-Electric Machines. W. J. Foster, assignor to General Electric Co. Starting of synchronous motors.

1,160,714. Electrically Controlled System for Moving-Picture Theaters. J. H. Hirschberg, Oakland, Cal. Traveling contact arm to control lights and apparatus.

1,160,716. Electrical Apparatus. A. Hundt, assignor to General Electric Co. Grounded safety device.

1,160,717. Alternating-Current Dynamo-Electric Machine. L. J. Hunt, assignor to General Electric Co. Windings and poles arranged for speed control.

1,160,718. Headlight. L. O. Ingalls, assignor to General Electric Co. Has adjustable lens.

1,160,736. Bracket and Fixture. W. Lumley, assignor to General Electric Co. Lamp-supporting arm for street use.

1,160,745. Filament Support. M. M. Merritt, assignor to General Electric Co. Filament supports extend along prolonged stem traversed by leading-in wires.

1,160,749. System of Electrical Distribution. G. S. Neeley, assignor to General Electric Co. Generator field windings regulated in battery system.

1,160,750. System of Distribution. H. F. Perkins, assignor to General Electric Co. Circuit supplied by vapor rectifier and direct-current generator.

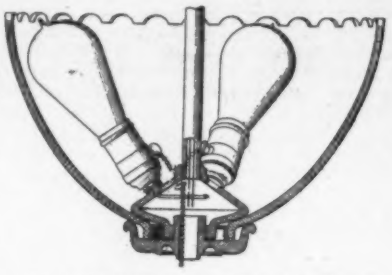
1,160,764. Lamp House for Picture-Projection Apparatus. A. D. Robinson, New York, N. Y., and A. P. Boller, Jr., East Orange, N. J. Special provision for dissipating heat.

1,160,766. Signaling Device. R. R. Root, Cleveland, O. Electromagnetically operated horn.

1,160,770. Electrically Driven Fan. A. Schaeffer, Frankfort-on-the-Main, Germany. Arrangement of face blades and motor in air douche.

1,160,771. Apparatus for Driving Electrical Machines. A. Schalkau, assignor to Siemens-Schuckert Werke, G. M. B. H., Berlin, Germany. Readings of indicator in motor circuit varied with motor load capacity.

1,160,776. Linotype Machine or the Like. J. P. Shufeldt, Jr., New York, N. Y., assignor of one-half to J. B. Allen. Electrical means to operate one of two matrix escapements.



No. 1,160,859.—Semi-Indirect Fixture.

1,160,795. Fire-Alarm System. F. X. Veranich, West Allis, Wis., assignor of one-half to F. Brandstätter. Thermostatically controlled mechanism.

1,160,811. Method of Producing Nitrogen Compounds. C. E. Acker, Ossining, N. Y., assignor to The Nitrogen Co. Includes electrolytic process.

1,160,822. Method of Reducing Metals. J. W. Beckman, Berkeley, Cal. Oxides reduced by melting in electric furnace and treating with reducing vapor mixed with air.

1,160,829. Tool for Detaching Obstructions from Electric Wire Conduits. M. Blumenthal, Brooklyn, N. Y. Toothed cutter for cleaning out cable conduits.

1,160,837. Carbureter. T. J. Burnham, Jackson, Miss. Electric heater in carbureting chamber.

1,160,842. System of Electrical Distribution. F. Castiglioni, Wilmette, Ill. Electrolysis of underground structure prevented by interconnection of traction systems.

1,160,844. Arcing-Ground Suppressor. A. Chernyshoff, assignor to Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Transformer primary shunts arc and secondary impedance is automatically varied.

1,160,847. Electrolysis of Alkali Chlorides or Alkali-Earth Chlorides. A. Clemm, Mannheim, Germany. Structure and arrangement of cell.

1,160,857. Electric Locomotive and Cable-Reeling Mechanism. F. C. Coseo, assignor to Jeffrey Mfg. Co., Columbus, O. Gearing automatically driving feeder-cable reel in either direction according to direction of movement of car.

1,160,859. Electric Lighting Fixture. J. H. Dale, New York, N. Y. Semi-indirect lighting fixture adapted for pull sockets. (See cut).

1,160,860. Electric Lighting Fixture. J. H. Dale. Convertible for direct or indirect lighting.

1,160,876. Sender-Board Apparatus. E. R. Gill, Yonkers, N. Y., assignor to Hall Switch & Signal Co. Board adapted for detachable mounting and connections of sending devices.

1,160,879. Chain Guide for Pull Switches. G. W. Goodridge, assignor to Bryant Electric Co., Bridgeport, Conn. Right-angled tube extends laterally from socket. (See cut).

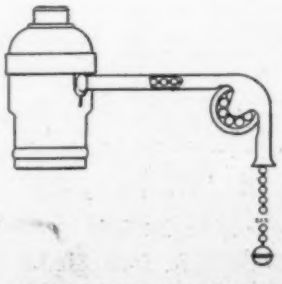
1,160,896. Fog-Signal for Trolley Lines. W. F. Hoeltke, Rochester, N. Y. Magnetic bell alarm connected with trolley for preventing rear-end collisions.

1,160,899 and 1,160,900. Mechanically Actuated Diaphragm Horn. M. R. Hutchinson, assignor to Lovell-McConnell Mfg. Co., Newark, N. J. Operated by motor-driven adjustable cam; mechanism in dustproof case.

1,160,901. Horn or Signaling Device. M. R. Hutchinson, assignor to Lovell-McConnell Mfg. Co. Modification of above.

1,160,902. Diaphragm Horn. D. A. McConnell, assignor to Lovell-McConnell Mfg. Co. Compact structure of motor and cam vibrator.

1,160,907. Dry Battery. I. Koretzky, assignor to L. J. Morrison, New York, N. Y. Has depolarizer of recovered manganese.



No. 1,160,879.—Pull-Switch Chain Guide.

1,161,911. Spark Plug. T. Latch, Galeton, Colo. Arrangement and shape of electrodes.

1,160,913. Street or Station Indicator. B. Ledermann, New York, N. Y. Swinging signs electromagnetically, selectively displayed from a bank of signs.

1,160,921. Electric Switch. J. F. McElroy, assignor to Consolidated Car-Heating Co., Albany, N. Y. Two-way oscillating switch with centering and locking spring.

1,160,950. Convertible Reflector for Lamps. M. J. Oestreich and H. N. Oestreich, Philadelphia, Pa. Has adjustable reflector shield.

1,160,951. Automatic Trunking System. O. V. Olson, assignor to Automatic Electric Co., Chicago, Ill. Line-switch-governing master switch is locked against motion while at rest.

1,160,959. Controlling Apparatus for Electric Railway Cars. A. Sundh, assignor to Otis Elevator Co., Yonkers, N. Y. Pneumo-electric system.

1,160,960. Surgeproof Transformer. C. H. Thordarson, Chicago, Ill. Secondary protected by arrangement of impedance and resistance.

1,160,993. Railway Signaling System and Apparatus. C. J. Coleman, assignor to Hall Signal Co. Block system depends on diversion of current from bonds between the two rails by passing car.

1,160,994. Pay-Station Telephone System. J. Erickson, assignor to First Trust & Savings Bank, Chicago, Ill. In automatic system, talking condition removed on calling and restored when coin is deposited.

1,160,995. Magneto-Electric Machine. J. B. Frawley, assignor to Pittsfield Spark Coil Co., Pittsfield, Mass. Inductor alternator type of magnet comprising timer casing; for ignition.

1,160,999. Galvanic Cell. M. L. Kaplan, Brooklyn, N. Y. Process of making miniature cell of Leclanché type.

1,161,005. Motor. W. H. Muzzy, New York, N. Y. Gasoline, lubricant and ignition spark simultaneously turned on to automobile engine.

1,161,010. Electrical Device. M. Setter, assignor to First Trust & Savings Bank, Chicago, Ill. Combined telephone drop and jack.

1,161,013. Thermal Valve. H. Stewart, assignor to Stewart-Kelly Automatic Drain Valve Co., Walla Walla, Wash. Thermally controlled operating magnet in drip valve structure.

Reissue No. 14,010. Selective Signaling System. E. R. Gill, assignor to Hall Switch & Signal Co. Combined telegraph and telephone lines.

Reissue No. 14,012. Method of, and Apparatus for, Selective Wireless Telegraphy. F. G. Sargent, Westford, Mass. Dial contactors synchronously adjusted at all the stations.

Patents Expired.

The following United States electrical patents expired on November 22, 1915:

614,453. Method of Manufacturing Electric Cables. S. Z. de Ferranti, Hollinwood, England.

614,462. Commutator. J. R. Grindrod, Lynn, Mass.

614,472. Potential Switch. J. D. Ihlder, Yonkers, N. Y.

614,474. Transformer Stamping. D. C. Jackson and W. B. Jackson, Madison, Wis.

614,484. Hanger for Electric Lamps. J. E. Mayo, Belvidere, Ill.

614,494. Fire and Burglar Alarm. J. L. Norris, Washington, D. C.

614,528. Electric-Lighting Gas Burner. J. M. Anck, Philadelphia, Pa.

614,539. Secondary Battery. N. H. Edgerton, Philadelphia, Pa.

614,571. Transformer System and Apparatus. A. Müller, Hagen, Germany.

614,572. Method of and Apparatus for Treating Ores. J. G. McNulty, New York, N. Y.

614,575. Conduit and Electric-Current Conductor for Surface Railways. A. Fetzenbürger, Gross Lichterfelde, Germany.

614,597. Means for Conveying Cables, Wires or the Like Through Underground Conduits. J. Wrigley, Elmira, N. Y.

614,608. Dynamo Electric Machine or Electromotor. E. Cantano, Pavie, Italy.

614,633. Electrolytic Apparatus. F. A. Thum, Newark, N. J.

614,677. Switchboard Apparatus, Signal and Circuit. T. C. Wales, Jr., Boston, and F. L. Rhodes, Winchester, Mass.

614,686. Magnetic Cutout. L. Andrews, Hastings, England.

614,759. Galvanic Battery. C. T. Richmond, Cleveland, O.

614,794. Circuit-Breaker. W. I. Crawford, St. Louis, Mo.